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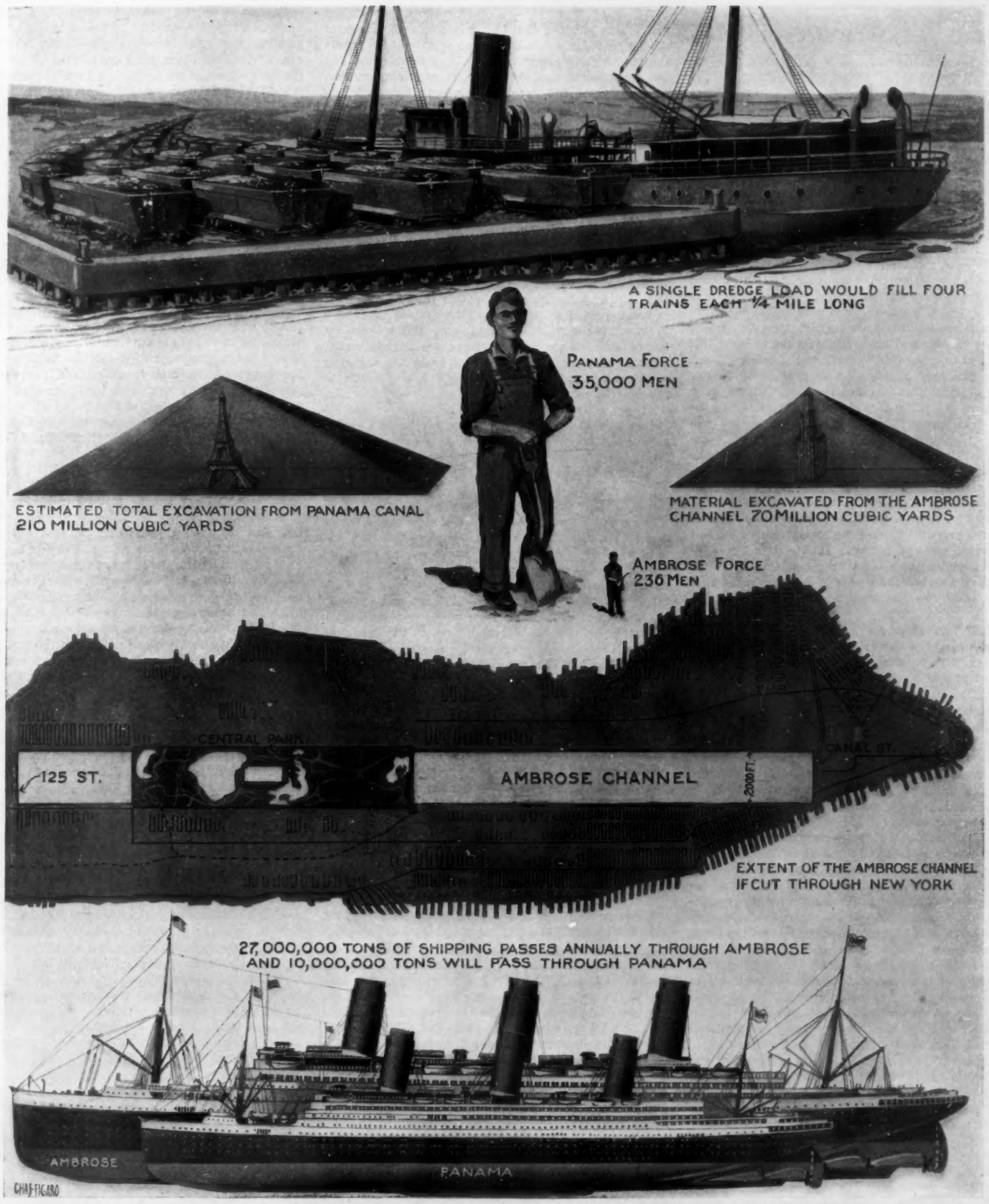

The Ambrose channel is one third the size of the Panama Canal; it has been excavated with one one-hundred and fiftieth of the number of men; it is now accommodating far more shipping than will the Panama Canal in many years to come.

THE AMBROSE CHANNEL AS MEASURED BY THE PANAMA CANAL.—[See page 242.]

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The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

The purpose of this journal is to record accurately, simply, and interestingly, the world's progress in scientific knowledge and industrial achievement.

The Minority Views on the Oldfield Bill

IN their excellently written report on the Oldfield Bill six of fourteen members of the House Committee on Patents have expressed their minority views on the folly of introducing compulsory licenses and of extinguishing the right of a patentee to treat license violations as patent infringements. Not only are the defects to which we have previously called attention mercilessly exposed, but others are revealed which show how hastily and how recklessly the Oldfield Bill was framed to cure "evils" which do not exist.

In the proposed introduction of compulsory license and in the limitations intended to prevent the patentee from fixing the price at which his invention may be sold or from prescribing the manner of its use, the minority members see nothing but danger. Compulsory working clauses are to be found in many of the European statutes. Not only are the European industrial conditions different from ours, but it seems to be the consensus of opinion that the compulsory working clauses of foreign countries have not been a success, and have discouraged the investment of capital in industries based on patents. If Representative Oldfield's bill were enacted into law, American inventors would be deprived of their present stimulus and would find it difficult to enlist financial support.

Even if the compulsory license principle could be successfully grafted on our patent system, the minority members of the Committee point out how impossible it would be to carry out Representative Oldfield's provisions and still do justice. So carelessly has the bill been framed that it contains no provisions to permit the intervention of a licensee in an action brought to compel the granting of a license. Hence a licensee might be kept in complete ignorance of a proceeding in the outcome of which he is vitally interested.

Equally reprehensible is the failure to deal with the situation arising from fractional or undivided interests in patent rights. The minority members point out that a patent may sometimes stand in the name of several owners. Is it sufficient to serve any one of them? Is it sufficient to pay royalities to one alone? If not, how are the other owners to be brought in and made parties?

The loose manner in which the words "patented invention" are used in the Oldfield Bill is severely criticised, and the results of the necessary construction, which a court would be compelled to place upon them, are tellingly set forth. Theoretically, every claim in a patent covers a distinct invention. In a patent containing fifty claims, twenty-five may cover inventions not actually embodied in the commercial product. Since every claim embodies a "patented invention," unlimited opportunities for engaging in compulsory license litigation are thus presented. This construction of the words "patented invention," however fantastic and far-fetched it may seem, is obligatory. If it were not adopted, the minority members fear that it would be possible to draw a patent with a hundred claims of which only one might be worked and ninety-nine withheld in flagrant evasion of the provisions for compulsory license.

According to Representative Oldfield and those who side with him an invention is suppressed if it is not adequately used. What is adequate use? In a previous issue we reviewed in these columns some of the difficulties encountered in interpreting the English statute containing a similar expression. The minority members point out still other difficulties. It is hard enough in an ordinary infringement suit to determine whether or not the defendant has used the complainant's invention. The same issues would be presented in compulsory license proceedings. In other words, an application for a compulsory license involves a consideration of a patent's validity and scope, of questions that inevitably arise in every infringement suit.

Let it not be supposed that the Oldfield Bill regards the mere non-use of a patent as a sufficient ground for the granting of a compulsory license. As the minority members of the Committee show, the right of the applicant for a license is dependent upon his demonstrating that the patented invention is being withheld or suppressed for the purpose or with the result of preventing others from competing with articles made by the patentee. "This plainly is an invitation to the easy circumvention of the law by the simple expedient of assigning the patent which it is desired to suppress to someone not engaged in producing any article in competition with the patented invention."

Was it oversight or simply a drastic discrimination against the patentee that induced those responsible for the Oldfield Bill to omit any provision which compels the applicant to accept a compulsory license and pay the royalties prescribed? An enemy of corporations, on reading the bill, would conclude that some industrial octopus stands behind Oldfield. How else could he explain the circumstance that those who can bear the cost of litigation will be enabled to apply indiscriminately for licenses and to accept only those which they may get on exceptionally good terms, with the privilege of abandoning the others after having put the defendant owners to heavy expense in establishing the value of their patents? The minority members fear that the entire assets of a small firm might easily be consumed in defending such a proceeding brought by a powerful corporation.

The amendment of the original Oldfield Bill so as to bring the patent monopoly within the Sherman Law is not approved by the minority. Framed as it was in executive session, without any public hearings to ascertain the views of inventors and manufacturers, the minority members feel that it cannot be seriously considered. That the Sherman Law is amply able to prevent the misuse of the patent monopoly, the minority prove by critically considering some of the decisions handed down in causes that involved an apparent conflict between the Sherman Law and the Patent Statutes. These decisions indicate that when there is no question of the right of excluding others from using or selling an invention in the manner prescribed by the patent law, the Sherman Act applies to patentees as well as to oil monopolists. Moreover, the very recent decision in the Bathtub Case demonstrated that the owners of patents are not exempt from the sweeping provisions of the Sherman anti-trust act against monopolistic combinations, and that there is no such inherent natural distinction between owners of patents and owners of unpatented staple products as to justify the application of the Sherman Law to the one class and not to the other. In a word, the proposed Oldfield recodification of our patent statutes is a brilliantly unnecessary piece of legislation, which has needlessly worried manufacturers and alarmed every business man who deals in patented articles.

Sir William White

WHILE most of us wander in life's byways, exerting but a vanishingly small influence on the progress of human affairs, into the lives of others is crowded such a wealth of events and activities, that the task accomplished seems, to the looker on, almost superhuman. In a space of sixteen years, from 1885 to 1902, William White, who has just passed from among us, designed two hundred and fifty warships. This was but one period in a life abounding with activity. A biography of the Father of the Modern Battleship appeared in our columns only a few months ago. The reader will remember that William White, born on February 2nd, 1845, began his apprenticeship in the Royal Dockyard at Devonport at the age of fourteen, and after eight years training in the practice and science of shipbuilding, entered, in 1867, the service of the constructive department of the British Admiralty. In 1870 he became secretary of the council of construction appointed on the retirement of Sir Edward Reed, chief constructor of the Royal Navy—a post later occupied by William White himself. During these years, in addition to his connection with the Admiralty, he also held the chair of naval architecture at the Royal Naval College, Greenwich. Among his students was Admiral Bowles, who later became Chief Constructor of our Navy. To this phase of Sir William White's activity must be reckoned also the publication of the well known "Manual of Naval Architecture."

In 1882 William White accepted an offer from the firm of Armstrong, Mitchell & Co. and became director of their new warship building department at Newcastle-on-Tyne. He held this post for three years, during which he superintended the construction of a new shipyard at Newcastle, and constructed warships for Japan, Italy, Austria, Spain, China, and the British Admiralty. The total value of the contracts secured within these three years was about eight million dollars. During this period the Secretary of the United States Navy purchased two cruiser designs prepared by William White, and from these the "Charleston" and "Baltimore" were built.

In October, 1885, William White was appointed Director of Naval Construction and Assistant Controller of the Royal Navy. Here he continued till 1902, when failing health compelled a rest from his arduous tasks—at the age of fifty-seven he retired from government service. Two years later he was able once more to resume active work as consulting naval architect for the Cunard liner "Mauretania."

That a man of the character of Sir William White should have taken an active part in the affairs of engineering societies and institutions is a matter of course. Many were the honors bestowed upon him—the knighthood in 1895, and the fellowship in the Royal Society in 1888 alone shall be mentioned here. But the most appropriate monument to a great man is a grateful appreciation of his work, and in this the memory of Sir William White shall not be found wanting.

The Scientific American Supplement

THE SCIENTIFIC AMERICAN SUPPLEMENT was founded in 1876 for the primary purpose of describing and illustrating the more important exhibits displayed at the Philadelphia International Exposition of that year. After the Exposition had closed, it was found that the SUPPLEMENT had earned for itself so great a prestige that it seemed unwise to suppress it. Accordingly, its publication was continued, and it was made a real SUPPLEMENT to the SCIENTIFIC AMERICAN in every sense of the word. While the SCIENTIFIC AMERICAN has always been primarily a newspaper in which the important scientific discoveries, engineering improvements and inventions of the day were promptly and briefly discussed, the SUPPLEMENT was reserved for the publication of highly important technical papers, read before learned scientific societies, and the translations from foreign publications of articles otherwise inaccessible to Americans.

The amount and character of the material thus printed is remarkable. Practically every field of science, both pure and applied, is represented. The articles themselves are penned, for the most part, by the most conspicuous investigators in their respective fields. Indeed, the best scientific thought of the day has always been concentrated in the pages of the SCIENTIFIC AMERICAN SUPPLEMENT in papers written by the most eminent chemists, engineers, physicists, physicians, biologists, and natural scientists. In that respect the publication stands probably unique among all periodicals. We would like to introduce and make thoroughly familiar to our readers some of the authors whose names appear at the head of the articles published in the SUPPLEMENT, but the list is so long that space does not permit to give more than a brief selection. We see there the names of George Westinghouse, Mr. Logan Waller Page, Prof. W. D. Bancroft, Dr. Baekeland, Prof. Bernthsen, Prof. Wilhelm Ostwald, Prof. Fleming, Sir Oliver Lodge, Sir J. J. Thomson, Prof. Leonard Hill, Sir William White, Sir Robert Hadfield, and many others noted for the important share which they have had in advancing the world's knowledge and power over natural forces.

Since the papers of such distinguished men have more than an evanescent value, a printed catalogue of SCIENTIFIC AMERICAN SUPPLEMENT articles is published from time to time, which is distributed gratuitously, and which indexes some ten thousand subjects that have been discussed from all angles. A complete file of past issues of the SUPPLEMENT, extending back to the year of its inception, thirty-seven years ago, is kept in stock, and copies can be supplied at any time at the published price. These files, together with the catalogue, form an unparalleled reference library within the reach of all at a nominal cost. So far as we are aware, no other scientific periodical has attempted and executed such a feat as this.

The SCIENTIFIC AMERICAN SUPPLEMENT is supported by its subscribers. It contains no paid advertising, in which respect it again stands unique among scientific periodicals.

An "Eiffel Tower" in Buenos Aires.—Application has been made to the municipality of Buenos Aires for a 60-year concession to erect on public property the "Torre Rivadavia," similar to the Eiffel Tower in Paris. It is to be 1,067 feet high, topped by a 106-foot statue bearing a light of 1,000,000 candle-power; making the total height 1,173 feet (Eiffel, 984 feet). It is to be equipped with a wireless station, a meteorological observatory, and an immense electrical clock.

Engineering

A Fatal Sawdust Explosion.—The falling of a bolt among the cutters on a machine for grinding sawdust in a box factory at Philadelphia is stated to have caused a shower of sparks which ignited the finely divided dust and caused an explosion which injured six employees and killed one. Explosions of this character are common in coal mines and they have occasionally occurred in flour mills and other industrial establishments where inflammable dust is generated.

Curious Drydock Disaster.—During a gale a drydock at Spotstown, Glasgow, was suddenly flooded by the inrush of water past the caisson gate, three of the workmen in the dock being drowned. The ship was moved from the keel blocks and she was filled with water, some of her plates being off at the time of the accident. An abnormally high tide caused the caisson to lift from its seat. A similar accident happened in one of the drydocks at the Brooklyn Navy Yard many years ago, when the caisson gate, not having been sufficiently ballasted, lifted during a high tide, the water rushing in and damaging two torpedo boats that were in the dock.

The Ingots to Blame.—At last the metallurgists, steel makers and rail users of the world are becoming thoroughly awake to the fact that the original seat of the defects which result in broken rails is the ingot. Hunt, Talbott, Hadfield and many other eminent authorities have recently shown that we cannot be sure of the quality of rails unless we are assured of the quality of the ingots. The latest paper to this effect is one by Bradley Stoughton. Our rail manufacturers are beginning to realize that they must concentrate their attention increasingly upon the furnace practice, and especially upon the ingot, if they are to turn out a reliable product.

In Touch by Wireless Across the Atlantic.—We are informed by the Hydrographic Office in New York that recently the steamship "Barbarossa" was in daily touch with the Hydrographic Office in this city by wireless throughout the whole of her voyage to the eastward across the Atlantic. Communication was maintained up to a distance of 800 miles by radio with the shore station of the Atlantic coast, when the "Barbarossa" came in touch with Crookhaven, Ireland, and the messages were transmitted back by cable. The office has arranged to keep a record of the positions of ships, transmitted by radio, and the location of ice and derelicts is being sent direct to the Hydrographic Office in Europe for transmission to ships starting on the westward passage.

Vast Increase of British Navy.—According to recent dispatches the programme for the increase of the British navy this year calls for five or six battleships, the number depending upon the Austrian naval programme. The programme at present calls for five battleships, six armored cruisers, twenty destroyers, several submarines and an addition of 5,000 men to the personnel, making a total of 142,500 officers and men. The cost of this programme will be $240,000,000. The battleships will be of large size, probably 28,000 tons, and it is said they will carry either eight 16-inch guns, each firing a 2,200-pound shell, or a larger number of 15-inch guns firing an 1,800-pound shell. We think that ten 15-inch guns will be the probable armament.

Bids for Building the "Pennsylvania."—Of the three best bids for the construction of our latest battleship the "Pennsylvania"—the largest ship authorized or under construction—made by the Newport News, the New York Shipbuilding and the Fore River companies, that of the Newport News yard of $7,255,000 was the lowest; and the contract has gone to that firm. The total cost of the ship when complete with guns, armor and equipment will be $14,173,000. The "Pennsylvania" was described in a recent issue, in which her dimensions were given as 600 feet between perpendiculars, 625 feet over all, beam 97 feet, and draught 29 feet. The maximum full-load displacement will be 32,500 tons. She will be the largest, best protected and most powerful ship afloat on the day of her launch.

Steel Trains on the New Haven Road.—The two five-hour expresses daily between New York and Boston over the New York, New Haven and Hartford R.R., are now made up of new all-steel Pullmans. These cars embody heavy cast steel U-shaped ends, forming the vestibules, connected by two heavy steel girders which make it well-nigh impossible for the cars to buckle or telescope. Each train consists of four parlor cars, a combination parlor and baggage car, a diner, and an observation smoker at the rear. The drawing-room has been dispensed with in the parlor cars. The ivory-white ceilings reflect the upwardly-thrown rays from ten 100-watt tungsten lamps, each of which is in a lacquered bronze bowl reflector. Each car has two sets of storage batteries connected in multiple, which provide enough current to run the lights when stops are being made at stations, and even for ten hours independently of the charging dynamo driven by a belt from the car axle. The Garland system of ventilation does away with all drafts. This system provides for the entrance of fresh air at the front of each car and the discharge of used air through ventilators in the deck sashes of the roof.

Electricity

Dr. Acheson Honored by the Czar.—The insignia and sash of the Order of St. Anne have been presented to Dr. Edward G. Acheson by the Czar of Russia. Dr. Acheson visited Russia to address the Russian Imperial Technological Institute in order to explain the nature and use of deflocculated graphite. The order of St. Anne is one of the highest honors that can be conferred in the Russian Empire and carries with it nobility to the recipient. Dr. Acheson is now listed as a noble of the Russian Empire.

Transformers in the Lamp Sockets.—The new German method of using a miniature transformer in each lamp socket has the advantage of allowing the use of a low-voltage metallic filament lamp, for instance a 14-volt lamp, and such filaments are much stouter than the usual kind. It is also claimed that the low-volt lamp is more economical in its use of current, and besides, the lamp is from 50 to 70 per cent cheaper to make than the others. Low candle-power lamps from 3 candle-power up can now be made with thick filaments, when using 14 volts. The usual 16 candle-power lamp has two filaments side by side, so that one can break and the other holds good. Each lamp has a small transformer fitted into the socket, and the key turns off the primary coil of the transformer, so that there is no leakage current.

Making Nickel Tubes Electrolytically.—Nickel tubes and other objects are made by the new Ed. Levi process, as it allows of obtaining a thick deposit of nickel in a special plating bath. An acid solution of nickel sulphate is used, preferably as a hot bath. Nickel anodes are employed, and the voltage between electrodes should not exceed 3 volts. The density of current is 2 to 3 amperes per square decimeter of surface, and even more, as it is preferable to use a high-current density in this process. A very acid bath at 10 or 15 degrees B. is recommended. The nickel thus obtained is very even and can be plated in a thick layer. Nickel is deposited in this way on an aluminium form, then the form is separated by dissolving in caustic potash or by melting. A tube is best for this form. Thus the nickel is left in the shape of a tube, and the metal is said to be very tough and malleable.

Electricity from Peat.—In a paper read before the Mechanical Engineers' Society, M. Bartel brings out some ideas in the way of utilizing the great natural resources which North Germany has in the shape of extensive peat fields, so that this can be used for a good part of the steam power needed for control stations. To keep pace with coming needs in this region there will have to be erected a number of electric plants giving a total of 10,000,000 horse-power, counting 8,000,000 for the use of railroads alone. As this part of the country has but little hydraulic power, steam will be needed, and peat fuel is recommended by the author. In this way the great marshes or bogs would be dried up so as to leave a large amount of land for agriculture and the like. In fact he calculates that North Germany contains enough peat to supply all the current needed in this region for as much as 250 years to come.

Electroculture by High-tension Discharge System.—A recent issue of a German electrical paper reports some successful experiments at Petrovic (near Prague) in stimulating the growth of vegetables by high-tension discharges from a network of steel wires stretched across the field at a height of twelve feet above the ground. High-frequency electrical energy was transformed up to 100,000 volts and then rectified for delivery to the network. The total power consumption for the ninety acres constituting the "plant" was two amperes at 120 volts. By turning on the current for a few hours each day—except during wet weather, and during very hot weather when the discharge treatment is useless or even injurious—the quality as well as the yield of the crops was much improved. It was concluded that a similar plant designed to take a large output of electrical energy would pay for itself during the first year of operation.

Flame Detector of Hertzian Waves.—It is found by the German scientist Leithauser that a flame will act as a detector for wireless waves. At the sending end is an induction coil giving a 0.2-inch spark and an antenna wire 5 feet long, and at the receiving end placed about 60 feet off there is mounted an antenna which connects to one electrode placed within the flame of a Bunsen burner, the second electrode being connected to ground. The first electrode consists of a platinium capsule containing carbonate of potash, and the flame keeps it at a red heat so as to melt the salt. The other electrode is a 0.04-inch copper wire placed horizontally at about 0.1 or 0.15 inch from the first. Wires lead from each to a telephone, or in other cases a galvanometer. At each wave signal sent out, there is heard a sound in the telephone. The current set up in the telephone seems to be caused by the flame acting as a current rectifier. Potash salts appear to give the best results, and both electrodes must be kept at a red heat, however a difference of temperature is needed between them, and it should be noted that the direction of the current given off by the flame combination which appears to work as a battery, depends on which of the metal pieces has the higher temperature.

Science

The Death of Lieut. Francis L. Harris.—The last survivor of the Hayes arctic expedition, which went forth in search of Franklin in 1860, died in Boston in the 89th year of his age recently. He was Lieut. Francis L. Harris. Although it stayed in the Arctic about two years and suffered great hardship, the expedition did not find Franklin. After the return of the expedition, Lieut. Harris enlisted in the Union Navy and fought throughout the war.

The Death of Dr. P. H. Hiss, Jr.—Dr. Philip Hanson Hiss, Jr., professor of bacteriology in the College of Physicians and Surgeons of Columbia University, died recently in New York city, after a long illness. Although only forty-five years of age, Dr. Hiss had made a reputation for himself, chiefly for his method of differentiating typhoid and colon baccilli; his method of isolating typhoid baccilli; his studies of the bacteriology of typhoid fever; his determinations of the relation of serum globulin and diphtheritic antitoxin; and his differentiation of pneumococcus and streptococcus and capsule staining methods. His recognition of dysentery, typhoid and allied baccilli, his researches on the baccilli of the dysentery group, and his study of the curative influence of extracts of leucocytes upon infections also deserve mention.

Water Hardness and Health.—Hardness of water, that is the amount of lime or other salts which it contains, appears to have a direct influence upon the health, as the researches of Dr. H. Roemer of Berlin bring out. Dentition is much influenced, as observed in the case of school children, and examining several thousand he finds that the percentage of persons having entirely sound teeth varies from 1.3 up to 20.2 per cent, according to the degree of hardness of the water in various localities. Hard water containing lime acts favorably in this case, and magnesia appears to harden the enamel. The number of young men adapted for military service also increases in regions having hard water. As to action on the blood, lime and magnesia act by their alkaline properties to strengthen the growth of children. According to this, he states that soft water should be used for washing and cooking, and hard water for drinking purposes.

The Turkey Buzzard and the Hummingbird in the House of Representatives.—On February 8th, Mr. Akin of New York submitted the following resolution in the House of Representatives which resolution was referred to the Committee on Agriculture and ordered to be printed:

> Resolved, That the Secretary of Agriculture be, and he is hereby, authorized and directed to expend not exceeding $1,000 in the purchase of six high-grade, thoroughbred, male turkey buzzards and ninety-nine thoroughbred humming birds, each to be examined and passed upon by Dr. A. D. Melvin, Chief of the Bureau of Animal Industry, as to soundness of limb and heart strength, in order that a test may be made as to the value of the offspring, be they gnats or fleas, for agricultural purposes, and to report to Congress whether the experiment is more valuable to the American farmer than the one now going on in this bureau where thousands of dollars have been expended in buying zebras in Africa and transporting the same to the District of Columbia, where they are joined in wedlock to Missouri mules, the offspring of which seem to be a cross between a North Dakota jack rabbit and an Australian kangaroo; and the sum of $1,000, or so much thereof as may be necessary, is hereby appropriated, out of the contingent fund of the House, to carry out the purposes of this resolution.

Those responsible for the printing of this absurd resolution ought to take a course in the correct appreciation of jokes.

Detroit Observatory of the University of Michigan has just issued the first installment of its "Publications," including an historical sketch of the institution by its present director, Prof. W. J. Hussey. It is, in several respects, among the most interesting observatories in America. It was built in 1854 with money raised by citizens of Detroit; whence its misleading name. (It is situated at Ann Arbor.) It was equipped, at the outset, with a 12¼-inch refractor, by Fitz of New York—still in use—which was, when built, the third largest refractor in the world, and the first large telescope constructed entirely in the United States. The observatory is almost unrivaled among American institutions in the number of distinguished astronomers who have been connected with it, as directors, members of the staff, or students. A picturesque chapter in the history of the observatory relates to the discovery of 22 minor planets, between the years 1863 and 1877, by Prof. Watson. One of these, Aethra, has been lost; no observations of it having been obtained since those made at the time of its discovery, in 1873, which were not sufficient for a satisfactory determination of its orbit. The planets discovered by Watson are "endowed;" the discoverer left a sum of money with the National Academy of Sciences to be used in preparing and publishing tables for these bodies, and the first installment appeared in 1910. Since 1911 the director of Detroit Observatory has also been director of the Observatory of La Plata, in Argentina, dividing his time between the two institutions. What with the observatory's misplaced name, Watson's "endowed" planets, and Hussey's shuttling between antisician institutions, the history of Detroit Observatory has certainly been tinged with bizarrerie.

The Curtiss Military Biplane

Description of the New Curtiss Tractor Aeroplane for Army Use

By Stanley Yale Beach

THE new Curtiss biplane illustrated herewith has been produced in fulfillment of the specifications for army aeroplanes issued by the Government early this year. These requirements have been published in the SUPPLEMENT No. 1940, and a *résumé* of them was given in our last issue. The chief requirements are that the machine must carry a load of some 600 pounds during a 4-hour flight; that it must rise at the rate of 200 feet a minute, and that it must have a maximum speed not exceeding 65 miles an hour.

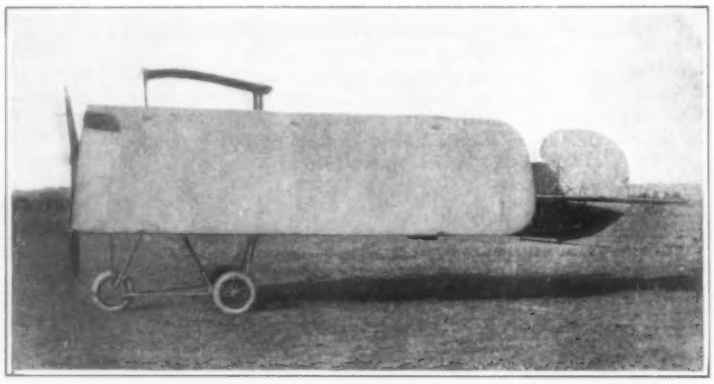
To fulfill these requirements Curtiss has produced a rather large biplane having a spread of 37 feet 4 inches for the upper plane and a total over-all width of 38 feet 4 inches, as against a length of 24 feet. The chord of each plane is 61 inches and their spacing apart 66. The weight of the machine complete is 1,050 pounds.

As will be noticed from the photographs, this new machine is radically different from the former Curtiss military biplane. The use of a covered fuselage is in partial fulfillment of the army requirements, and this, together with the placing of the power plant and propeller in front, follows European practice. The complete covering of the fuselage to reduce head resistance, and the arranging of the radiator and motor in front, with a bonnet similar to that used on automobiles, is distinctly novel as regards a Curtiss machine. The wings are made up each in one piece instead of in sections as heretofore, and they are so set that their front and rear edges form a slight dihedral angle extending backward from front to rear. This form tends to give the machine a certain degree of inherent fore-and-aft stability. The unit construction of each wing and the method of fitting the tail, rudder, etc., make it possible to take apart the machine or put it together again in less than half an hour. One of our illustrations shows the four wings placed beside the body when the machine is to be towed over the road.

The three-wheeled chassis has a maximum width of 65 inches reduced to 42 inches at the fuselage, while the tread is 56 inches. The body is wide enough for two men to be seated in it comfortably, and there is a panel removable from the lower plane on each side of the body to allow the occupants to look directly downward if they so desire.

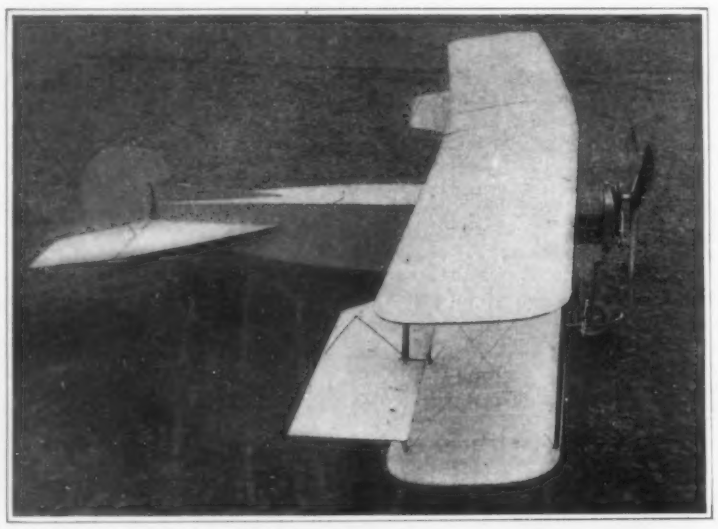
Each aviator has a separate control wheel so that either man, or both together, can drive the machine. A 40-gallon gasoline tank is placed under the seats, but for running the aeroplane a small 2-gallon tank on the dashboard is kept filled by means of a pump driven from the engine. A glass plate in the face of this tank makes it possible to see at all times the amount of gasoline in the tank and whether or not the pump is working. Should the supply from the main tank cease, by throwing a small lever and giving a few strokes of a hand air pump, the gasoline will flow from the main tank by means of air pressure developed therein. Another convenience is the carrying off of the oil and smoke from the engine below the body by means of pipes. The up-curved dash in front of the aviators directs the blast of air from the propeller above their heads, also. Although this is the largest machine thus far built by Curtiss, it can be knocked down and packed in three small boxes in short order. To collapse any of the four wings completely so that they will fill a space but six inches wide, it is only necessary to remove four bolts.

The new method of wiring and bracing used in the fuselage does not require any holes to be pierced in the main longitudinals, which are made of white spruce and which taper from the front to the rear. The body is so light that it supports itself, a light skid being placed under the tail for protection only in making a bad landing. The head resistance of this machine has been reduced so that the machine is as fast as any of the lighter bodyless types now used by the army. It is, therefore, a distinct advance as far as American military aeroplanes are concerned.



Machine with wings placed beside the body for towing over the road.

Front view of the new tractor biplane in flight, showing comfortable seating of the aviators.



Side view of the latest Curtiss military biplane.

Note dihedral angle of wings as viewed from above, the ailerons, the three-bladed propeller, covered fuselage, and fan tail.

A Canadian Arctic Expedition

VILHJALMUR STEFANSSON, well known for his explorations along the Arctic shores of British America and for his discovery of Lloud Eskimos, has for some time been planning an expedition to seek for new lands in the vast unexplored region lying to the north of the Beaufort Sea and the Parry Archipelago. He recently secured the financial backing of the American Museum of Natural History, the National Geographic Society, and the Harvard Travelers' Club; but shortly afterward was invited by the Canadian government to undertake the journey under its auspices and at its expense. He has accordingly been released by the three American societies and the expedition will sail under the British flag. Stefansson is a Canadian by birth, but was educated in the United States.

The expedition is expected to sail from Esquimault, B. C., the latter part of May on the whaler "Karluk," just purchased for this purpose, and to spend about three and a half years in the Arctic. Dr. R. M. Anderson is to be second in command, and the scientific staff will probably consist chiefly of Canadians. The region to be explored is the largest stretch of completely unknown sea or land in the northern hemisphere. Certain peculiarities of the tides seem to indicate that it contains extensive land areas. On the eastern border of this region is the supposed location of Crocker Land, which was sighted by Peary on his journey to the pole, and is to be sought by Macmillan's forthcoming "Crocker Land Expedition." It should also be noted that Amundsen's projected drift across the North Polar Basin will probably carry him into this unknown area.

Stefansson hopes to land at Prince Patrick Island next September and establish his main base at Land's End. The ship is to leave him here, return to civilization, and thereafter to make yearly visits to the base. Of course any such programme is liable to be more or less modified by ice conditions. From Land's End the party expects to make sledging journeys in various directions over as much as possible of the million square miles that are now a blank on the map.

The expedition will be equipped with a powerful wireless telegraph outfit, and it is hoped that the base station will thus be kept in constant communication with the world. This ought not to be difficult, since the Canadian government is now establishing a chain of wireless stations in the far north of British America, including one at Herschell Island, at the mouth of the Mackenzie River. It is also proposed to carry a wireless outfit on the sledge, in order to keep the explorers in touch with their base. A moving picture machine is to be included in the equipment of the expedition.

Court Decides Against the Taggart Dental Inlay Patent

MUCH interest is taken by dentists in the decision of the Court of Appeals of the District of Columbia voiding the Taggart patent, No. 872,978, of December 3rd, 1907, upon a divisional application filed July 12th, 1907, of original application filed January 12th, 1907. This decision, the opinion in which was rendered by Mr. Justice Robb, reverses the decision of the Supreme Court of the District of Columbia, which decision sustained the Taggart patent. Defense was made that the invention had prior to Dr. Taggart's invention been taught, used and operated, at least two years before the filing of the Taggart application for patent. The Court said that it was fully persuaded that the evidence shows beyond a reasonable doubt that for many years prior to the filing of the application for patent the process of making patterns and molds for dental inlays and the like, as expressed in the claims, had been publicly practised upon many occasions, and that it was of no possible consequence that by the use of Dr. Taggart's machine, gold inlays and the like might be produced more cheaply and rapidly than they were produced by dentists who had testified in the case. The Court goes on to say that the art of producing metal castings by means of a mold formed of a wax pattern is very old, was practised by the ancient Greeks and Romans, extensively used in the middle ages for producing statuary, and is known as the *Cire perdu* or "lost wax" process.

A Chair of Sericulture has been created in the scientific department of the University of Lyon, France, as a part of the general instruction in applied zoology. Funds for the payment of a professor and an assistant have been raised by the local chamber of commerce, as one means toward maintaining the supremacy of Lyon in the silk industries of Europe.

The Growth of a Great Navy

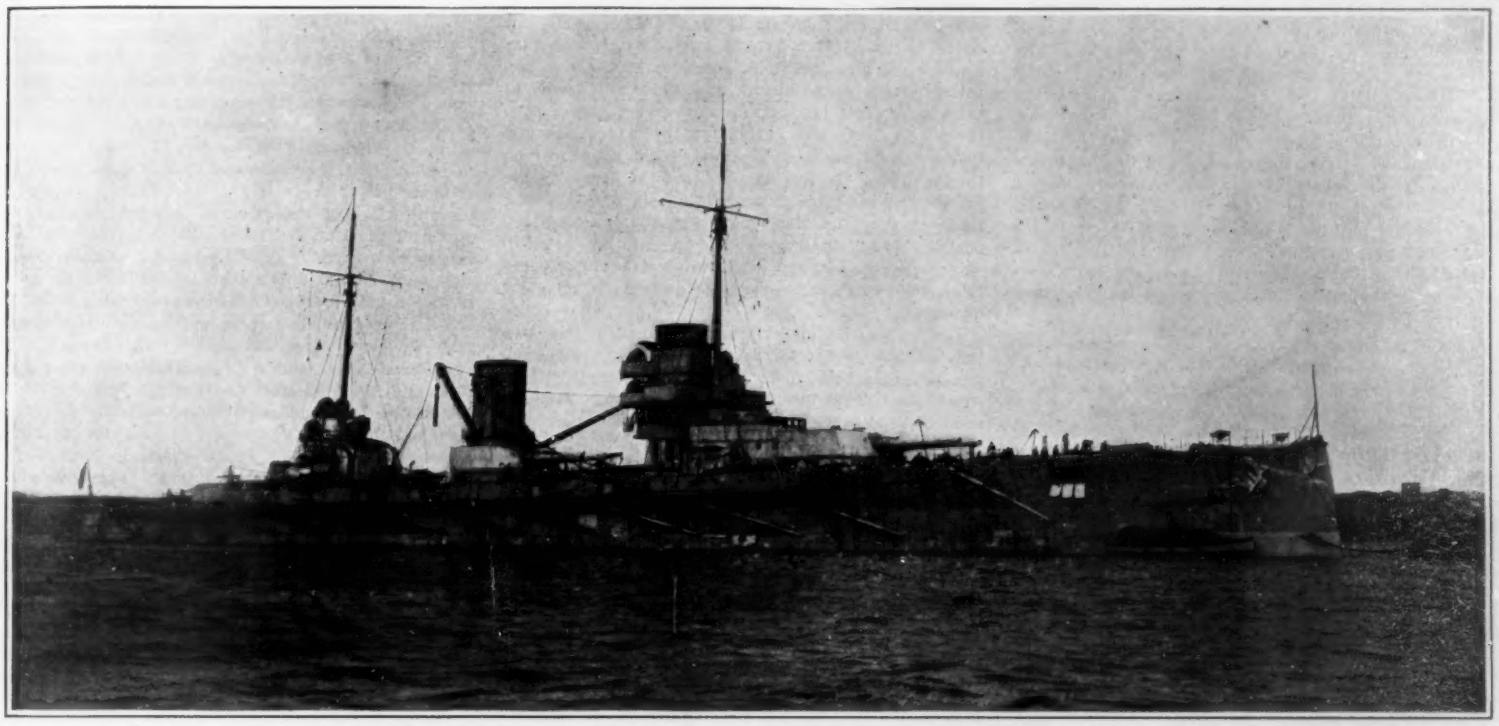
How Germany Has Advanced to the Second Position

By Percival A. Hislam

THERE has been a vast number of changes in the last few years in everything that affects naval power, but none is more remarkable than the rise of Germany from a position of absolute insignificance into that of the world's second sea power. The work has been accomplished in the face of extraordinary natural difficulties, for not only are the German people essentially agrarian, but their harbors on the open seacoast have had literally to be dug out of the mud; and she must always remain under the heaviest of Nature's handicaps, for the island of Great Britain stretches like a great breakwater between Germany and the ocean.

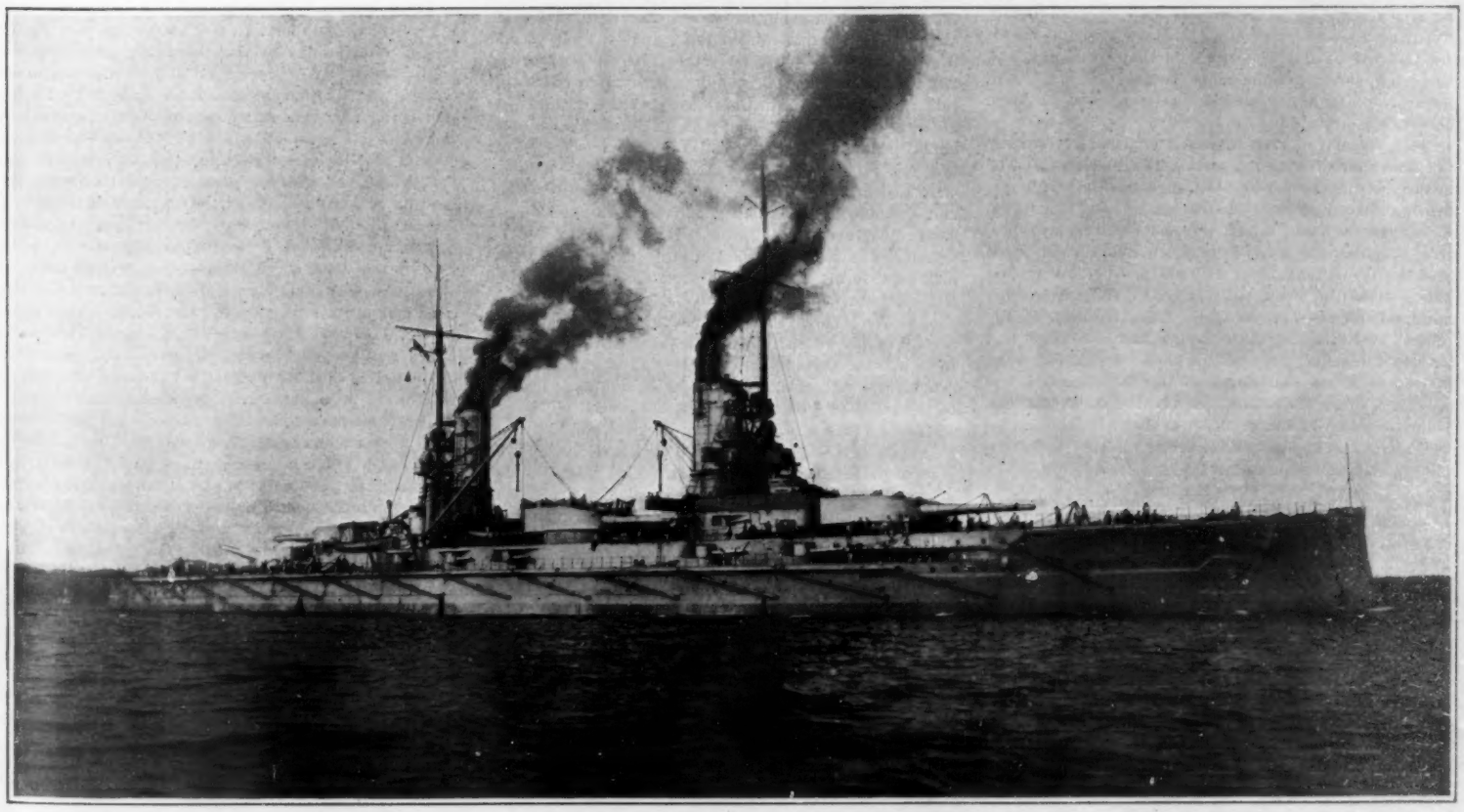
Considering the part Germany plays to-day in the naval politics of the world—she has 11 completed dreadnoughts to England's 18, and to America's 8—it is difficult to realize that her naval expenditure did not reach $25,000,000 until 1897, and that the fifty-million dollar mark was not passed until ten years ago. From 1908 onward her naval expenditure has totaled well under a half of Great Britain's, and yet in that period she has launched 18 armored ships as compared with that nation's 22, and with the 10 of the United States. The German fleet is largely manned on the conscript system, and it is this, of course, which accounts very largely for the cheapness of her naval service.

To realize the truly marvelous growth of German naval strength, it is not necessary to go back more than ten years. In 1902 her naval expenditure was $50,225,000, and it has increased so rapidly that no less than $113,047,200 is being spent this year. The number of officers and men voted for the fleet in 1902 was 33,500. For the current year the figure is 62,670, and under the recently adopted amendment to the navy law of 1900 the personnel is to be increased to 101,500 by 1920. For two years after England completed the "Dreadnought" (in 1906) Germany was passing into service battleships of 13,040 tons, more than 30 per cent short of her displacement; but the armored



Length, 610¼ feet. **Beam,** 96 feet. **Displacement,** 22,640 tons. **Speed on trial,** 29 knots. **Armament,** ten 11-inch, twelve 5.9-inch, twelve 3.4-inch, four torpedo tubes. **Main armor belt,** 7½-inch. **Coal,** 3,100 tons. **Oil,** 200 tons.

Germany's latest battle-cruiser, "Goeben."



Length, 564¼ feet. **Beam,** 95¼ feet. **Displacement,** 24,110 tons. **Trial speed,** 22 to 23 knots. **Armament,** ten 12.2-inch, fourteen 5.9-inch, fourteen 3.4-inch, six torpedo tubes. **Main armor belt,** 12¾-inch. **Coal,** 3,600 tons. **Oil,** 300 tons.

The latest German dreadnought, "Kaiser."

ships launched for Germany from 1909 onward have actually exceeded in average displacement the vessels launched for the British navy. It has been truly said that a battle fleet is not made in a shipbuilding yard or alongside a dockyard wall, but on the high seas; and if the German fleet be measured on this basis, its progress will be found no less striking. In 1902 the "High Sea Fleet" consisted of 8 battleships, 2 armored cruisers, and 22 destroyers. To-day it consists of 18 battleships, 4 armored cruisers, 12 small cruisers and 66 destroyers; and by 1914 it is to be increased (under the provisions of the recent amendment to the navy law) to 25 battleships, 8 battle and armored cruisers, 18 small cruisers, 90 destroyers, and 54 submarines, all of which will be permanently in full commission.

Naturally, the rise of Germany at sea is felt much more keenly in England than in any other country, if only because a distance of no more than 300 miles separates the principal German naval base of Wilhelmshaven from the English North Sea coast. Whether Germany hopes some day to become the world's principal naval power (and the Kaiser has said, "The trident of Neptune must be in our fist," and "Our future lies on the water"), is a political matter that cannot be discussed here; but she has at any rate made such progress in that direction that since 1904 Great Britain has been compelled, in order to preserve her superiority in her home seas, to withdraw 19 battleships from foreign stations (14 from the Mediterranean and 5 from the Pacific) and to concentrate practically the whole of her resources around her shores. The extent to which Germany has actually improved her position is shown very strikingly in the following comparison between her fleet and the British in 1904 and at the present time in the principal classes of ships, excluding in all cases vessels launched over ten years:

	1904		1912	
	Britain.	Germany.	Britain.	Germany.
Battleships	30	10	27	18
Battle cruisers ...	..	..	5	3
Armored cruisers.	19	4	21	6
Protected cruisers	37	17	15	22
Destroyers	120	37	107	88

When the original dreadnought was laid down in 1905 it was claimed in England that the new type of ship would not only strengthen her position very greatly against other important naval powers, but that smaller nations with pretensions to a fleet would be quite driven out of business. This is very far from being the actual result. Some of the minor nations that had not laid down a battleship for a quarter of a century or thereabout are now engaged in more or less ambitious dreadnought programmes, these including Brazil, Argentine, Chili, Turkey, and Spain. So far as Germany was concerned, it enabled her to start afresh with a clean slate; and although it is true that the appearance of the "Dreadnought" paralyzed the shipyards of Europe for nearly two years, they were merely preparing themselves properly for the struggle before they started on it. The result is that while England completed seven dreadnoughts before Germany completed one, the latter nation has completed 11 since 1908 to England's 11.

Again, until the "Dreadnought" appeared Germany had been content with comparatively feeble ships. The battleships she launched between 1892 and 1901 carried nothing larger than the 9.4-inch gun, and the ships of the "Deutschland" class, the last of Germany's predreadnoughts, displaced only 13,040 tons as compared with the 16,500 tons of the British "Lord Nelsons." and the 16,000 of the "New Hampshires." The first American dreadnoughts were no larger than the "New Hampshires," and the step between the "Lord Nelson" and the "Dreadnought" was only 1,400 tons; but Germany jumped from the 13,040 tons of the "Deutschlands" to the 18,600 of the "Nassaus," an advance of 42 per cent. This phase of German progress is shown in the following table, which gives the average tonnage of battleships launched in successive years:

	American.	British.	German.
1905	14,800	16,350	13,040
1906	16,000	16,966	13,040
1907	.....	18,600	.....
1908	17,333	19,250	18,600
1909	20,912	19,575	22,440
1910	21,825	20,833	22,440
1911	26,000	22,940	24,110

Thus, while American designs have gained and kept a considerable lead over both nations' ships, those of Germany have, compared with British vessels, risen from an inferiority of 3,310 tons in 1905 to a superiority of 1,170 tons in 1911. On the other hand, however, German designers do not seem to have the knack of converting tonnage into fighting power. Their 24,110-ton ships of the "Kaiser" class mount only ten 12.2-inch guns in their main battery, representing a broadside fire (over a limited angle) of 9,810 pounds. The corresponding British ships have ten 13.5-inch on the center line, with a broadside of 12,500 pounds, while the American "Wyomings" have a broadside of 10,440 pounds, and the "New Yorks," 14,000 pounds. The German vessels have a large anti-torpedo battery—fourteen 5.9-inch and fourteen 3.4-inch, as compared with twenty-one 5-inch in the American, and sixteen 4-inch in the British ships; but while a battleship is, of course, a compromise, the battle guns of the German ships of the "Kaiser" class give 407 pounds of broadside for every 1,000 tons displacement as compared with 529 pounds in the British "King George" class and 518 pounds in the "New York."

The German navy now comprises 8 battleships and 3 cruisers of the dreadnought type in service and 9 battleships and 3 cruisers in various stages of construction. The four earliest battleships, "Nassau," "Westfalen," "Rheinland," and "Posen," were launched in 1908. They displace 18,600 tons, and with reciprocating engines of 20,000 horse-power have steamed from 20.1 to 21.4 knots, while their armament consists of twelve 11-inch, twelve 5.9-inch and sixteen 3.4-inch guns. They were followed by the "Helgoland," "Thüringen," "Ostfriesland," and "Oldenburg," launched in 1909-10, and displacing 22,440 tons. Their armament consists of twelve 12.2-inch, fourteen 5.9-inch, and fourteen 3.4-inch guns, and their speeds (with 25,000 horsepower) range from 20.8 to 21.6 knots. These eight ships have their big guns arranged very inefficiently, there being only two turrets on the center line and two on either beam, so that only eight guns bear on the broadside. Thus it happens that the broadside fire of the "Nassau" (18,600 tons) is only 6,080 pounds, while that of the "Michigan" (16,000 tons) is 6,960 pounds. The main armor belt of the first four German ships is 9¾ inches, and of the latter four, 10¾ inches thick, reduced in each case to 6 inches forward and 4 inches aft.

The battleships under construction fall into two groups. The first comprises the "Kaiser," "Friedrich der Grosse" (both under trial), "Kaiserin," "König Albert" and "Prinzregent Luitpold," having a displacement of 24,110 tons, a designed speed of 20 knots (the "Kaiser" has made over 23 in a spurt on trial), and an armament of ten 12.2-inch, fourteen 5.9-inch, and fourteen 3.4-inch guns. The main weapons are in five turrets, of which three are on the middle line, one forward and two aft, the inner of the after pair being superposed to bear astern. The other two turrets are *en échelon* amidships, so that there is nominally a full broadside. The angle covered by ten guns is, however, necessarily small (about 30 degrees), and while the armor belt is increased to 12 inches, it does not appear that very good value has been obtained for the increase of 1,800 tons over the preceding group. The "Kaisers" are the first German battleships driven by turbines, the horse-power being 28,000.

Of the later battleships very little is known save that the authorities are having a good deal of trouble over their armament. The vessels concerned are known as the "Ersatz Weissenburg," "Ersatz Kurfurst," Friedrich Wilhelm," "Ersatz Brandenburg," and "S." It was at first intended to give them either thirteen or fourteen 12.2-inch guns; but this would have involved triple turrets, and these have, in Germany, proved a failure. As an alternative, ten 14-inch were decided on; but here again, while Krupps have had a 14-inch on hand for a long time, they have been unable to produce a mounting that satisfies the requirements of the Admiralty officials. There is a possibility of twelve 12.2-inch in six center-line turrets being adopted as a solution.

America has already made the acquaintance of German battle-cruisers, the "Von der Tann" having visited the southern continent in 1910-11, while the "Moltke" was at New York recently. The former is practically a copy of the British "Indefatigable," having eight 11-inch in four turrets, two on the center line and two *echeloned*, well apart longitudinally, amidships. Her torpedo defense battery consists of ten 5.9-inch and sixteen 3.4-inch guns, while her best recorded speed is 28 knots with turbines of 44,000 designed horse-power. Her displacement is 19,100 tons. The "Moltke," her successor in order of building, displaces 22,640 tons and carries an additional pair of 11-inch guns in a superposed turret aft. She has made 29.7 knots with turbines developing 80,000 horse-power. The recently completed "Goeben" is similar to the "Moltke," but has been credited with a maximum speed of 32 knots. Experience shows, however, that German newspaper reports always exaggerate the speed of their new ships.

Comparative Dreadnought Strength.

	Complete.	Building.*	Battle Guns in Completed Ships. Total.	Broadside.
Britain	18	18	170	156
Germany	11	12	124	92
United States ..	8	5	80	80
Japan	2	5	24	16
Brazil	2	1	24	20
Italy	1	7	12	12
Austria	1	3	12	12

* Including those provided for in 1912.

It is understood that the last battle-cruiser to be launched, the "Seydlitz," will carry ten 12.2-inch on a displacement of 27,000 tons, but of the remaining vessels, the "K" and the "Ersatz Kaiserin Augusta," of the 1911 and 1912 programmes, nothing definite is known.

No other nation has yet completed a ship of the all-big-gun type.

The Ambrose Channel as Measured by the Panama Canal

WHEN we place two objects side by side for comparison, we may be trying either to magnify the superiority of the one or the inferiority of the other, or again, we may be merely using one as a standard by which to measure the other. It is with this last impartial and dispassionate purpose in view that we have placed some figures relating to the Ambrose Channel beside similar figures relating to the Panama Canal.

When we learned that the broad ship channel cut through the shoals of New York's lower bay was 96 per cent completed, that nearly sixty-five million cubic yards had been removed from it, and that some five million yards were still to be dredged up, we knew that we had a large quantity to deal with; but how large, it was difficult to grasp without using a bigger unit of measure. After searching about for a suitable yardstick, we were quite as astonished as our readers probably will be, to find that the Panama Canal is by no means too large a measure for the purpose. The estimated total excavation of the Panama Canal will amount to about two hundred and ten million cubic yards, or almost exactly three times that of the Ambrose Channel.

To show what this amount of material means in terms of units that are still more familiar to us, we have pictured in the front page illustration two pyramids similar in form, one made of the material excavated from the Ambrose Channel and the other from material excavated from the Panama Canal. Taking the smaller pyramid as 750 feet high, or just large enough to reach to the top of the Woolworth Building, the tallest office building in the world, the base of pyramid would be 2,750 feet square, that is, each side would have a length of eleven common street blocks.

A similar heap of dirt and rock from the Panama Canal would make a pyramid only 1,080 feet high, overtopping the Eiffel tower by something like 100 feet, while the base would measure 4,000 feet square.

How could a work of such great magnitude at our very door have escaped with so little comment? Can it be that things look larger and more important in proportion to their distance? No. This distortion of mental perspective is apparent, not real. There is no doubt that were the work not covered by a screen of water, it would receive great attention and even exaggerated importance. If the same excavation were made in New York city, it would cut a swath nearly as wide as Central Park, and stretching from Canal Street to 125th Street, and about 15 feet deep. But for the very reason that the channel has been dug under water, it is not nearly so important or difficult an engineering undertaking as that of the Panama Canal. Excavation with dredges is far more economical than excavation with steam shovels. The Ambrose Channel was started eleven years ago, and is now practically completed, and yet only four dredges at a time have been used on it, and these dredges were manned by 236 men altogether. At present only two dredges are used in completing the work. On the other hand, the excavation at the Isthmus of Panama has required the services of a veritable army of men. Thirty-five thousand men are now employed. As a matter of fact, what is left to be done in the way of cleaning up the Panama Canal will be accomplished by means of dredges after the canal is open to navigation, because this form of excavation is so much more economical and speedy.

Our front page illustration shows what an enormous load a single dredge will carry. The dredge is provided with two bins, each holding 1,400 cubic yards. To transport 2,800 cubic yards on land would require a train a mile in length, or, as shown in the illustration, four trains, each a quarter of a mile in length. These powerful suction dredges will take on a full load in less than three hours, then go out to deep water, drop the load, and return within two or three hours, depending upon whether their station is near the outer or the inner end of the channel. The load that is taken on is not, as one might suppose, a very fluid mixture of sand or mud and water. Of course, the sand is moist, but it is practically a solid load free from water. The material in the bins, unless it is mud, is so hard that one may walk upon the load without sinking in. As has been explained to our readers before, the material is sucked from the bottom through two pipes, one on each side of the hull, 20 inches in diameter, and provided with a drag at the lower end. The mixture of sand or mud and water is pumped up by powerful centrifugal pumps and delivered into the bins which, after filling, permit the water to overflow while the solids

settle. Thus the bins gradually fill up with the sediment. Mud settles slowly, and much of it is carried off with the overflow, so that when mud is being excavated it takes much longer to fill the bins.

At present practically all the work is completed except for a few stone piles, and for some excavation still to be done along the southern edge of the channel. The stone piles, by the way, are rather interesting. A number of years ago, when harbor regulations were not strictly enforced, it was quite the common thing to dump loads of stone in the lower bay. Many of these have been encountered in excavating the Ambrose Channel. The drags of the suction pipes have openings in them, measuring 7 inches by 8 inches, and will suck up anything of that size, be it stone or iron. However, most of the stones in the stone pile are too large to pass through the drag. They could be removed by using bucket dredges, but a simpler method was evolved, i. e., to bury the stones where they lay. To do this holes from ten to twenty feet deep are dredged around two sides of the stone piles, and then the survey boat with its water jets loosens the pile of stones, letting them fall into the grave dug for them.

The dredges are capable of excavating to a depth of sixty feet. The depth of the Ambrose Channel, however, is 40 feet below mean low water. The width of the channel, as we have stated before, is 2,000 feet, and the banks at each side have a 10 per cent slope.

The importance of this channel in terms of the tonnage of shipping that passes through it looms very large indeed. It has been estimated that for the first few years, the total tonnage of shipping passing through the Panama Canal will not greatly exceed ten million per annum. In 1920 it will probably reach thirteen million. Just how much shipping passes up the Ambrose Channel, it is difficult to determine. A record is kept of foreign vessels entering and clearing the port of New York, but no record is kept of coastwise shipping. The tonnage of shipping engaged in foreign trade amounts annually to about twenty-seven million, and practically all of it comes up through the Ambrose Channel. The coastwise tonnage is considerably more than this, but how much more no one can state definitely. For this reason we have left it out of consideration in our comparison, and have shown a single ship of ten million tonnage capacity representing the shipping that will pass through the Panama Canal, and a twenty-seven million ton ship representing the foreign shipping passing up through the Ambrose Channel.

It is a pity that a waterway of such great importance should have no visible banks. Passengers who go through the Panama Canal will ever praise the engineers who carried that great work to completion, as they see the enormous cut of Culebra, the huge Gatun dam, and the massive concrete locks. But the far greater number of passengers who take the trip through Ambrose Channel to or from New York city will remain perfectly oblivious to the magnitude of the submerged canal beneath them, and to the long years of tedious work spent upon it by devoted engineers.

The Current Supplement

IN an article on Modern Microscopical Optics C. Metz, in this week's issue of the SUPPLEMENT, discusses the limitations of the microscope, and the refinements in its optical system introduced by modern practice. The English correspondent of the SCIENTIFIC AMERICAN describes a remarkable aerial ropeway for tourists' service in the Tyrolese mountains.—An important article dealing with Methods of Fire Prevention tells us of the excellent work done by the British authorities in this direction.—Dr. R. C. Benner tells us "Why Smoke is an Industrial Nuisance."—"How to Make an Electroscope" is the title of an article by C. E. Benham.—Mr. John Jay Ide, familiar to our readers as the author of a number of articles on the principal types of aeroplanes, describes for us the Morane-Saulnier monoplane, the holder of the world's height record.—Prof. H. C. Jones of Johns Hopkins University writes on "Electricity and Chemical Action," a subject which he is peculiarly qualified to treat.—E. S. King investigates the question, whether interstellar space contains a medium which absorbs light.

Parcel Post Hampers

THE interest in parcel post appliances will be heightened by the report that Postmaster-General Hitchcock has made a contract for 6,000 hampers to be used in the carrying of parcel post packages. These hampers are intended partly for experimental purposes and are made to nest. They are constructed of canvas and some metal, as well as wood and fiber, is used in their construction. It is reported that hampers which can be collapsed have been found in most cases too fragile so that none of the type have been purchased as yet. Many forms of collapsible containers might be developed which would not be open to the objection referred to.

Correspondence

[The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.]

Spring Wheels

To the Editor of the SCIENTIFIC AMERICAN:

Referring to the letter in your issue of February 1st entitled "Fallacy of the Spring Wheel," Mr. Fischer states that the spring wheel will never become a practical success, his reason being that the springs in the wheel must undergo so many more flexures than the elliptical springs of the car.

This is of course true of a great number of spring wheels, but the obvious answer is that if the flexures of the springs in the wheel are in excess of the elliptical springs, the springs must be so placed in the wheel that no flexures occur in excess of the flexures of the elliptical springs.

New York city. HARRY E. SIPE.

The Bow Rudder

To the Editor of the SCIENTIFIC AMERICAN:

In your issue of January 25th, answering the letter of A. H. Kiehl, you make the following statement: "The bow rudder is in use on special types of vessels, particularly on ferryboats, the practice being common in American harbors."

All of the ferryboats on the Atlantic coast, of which I have record, are steered entirely by the after rudder, the forward rudder being locked, thereby losing the function of a rudder, in fact the forward rudder can be controlled only from the after pilot house.

I believe that under certain common conditions of current, the bow rudder could be used with success, but I have yet to see one in operation.

Princeton, N. J. ROSWELL DAVIS.

Position of Projectiles in Flight

To the Editor of the SCIENTIFIC AMERICAN:

"The Flight of Projectiles." *Re* article of Sidney Ballou in your issue of December 21st, 1912, page 581.

His second paragraph is as follows: "If a projectile rotated on an axis absolutely identical with its trajectory, the criticism would be sound; but it is just the slight departure from this condition that causes the drift. The moment the projectile leaves the gun, the force of gravity begins to pull it away from the path of the axis of its rotation, and this slight deviation is enough to make the analogy of the baseball applicable."

It might be well for the writer to point out the analogy referred to, especially since the drifts of a baseball and of a bullet are in opposite directions, as pointed out by Twining, and especially since Twining states that the causes of the two drifts are entirely distinct and different, in other words, that there is no analogy whatever.

Red Deer, Alberta. C. C. GRANT, M.D.

The Nature of the Patent Monopoly

To the Editor of the SCIENTIFIC AMERICAN:

Regarding the proposed legislation for eradication of the monopoly element from our patent laws:

Would it not be well to consider with exceeding care the matter of this alleged monopoly element, and to demonstrate conclusively its existence, before moving to eradicate it?

While in a general way it might be admitted by some that the inventor is a producer, there appears to be no intelligent understanding of the fundamentals of this so important subject, and the general opinion appears to be that in granting a patent to an inventor, society confers upon the latter a favor, a benevolence, and at the expense of society, for which gratuitous gift the inventor is obligated to society, as, for instance, he would be should he receive free a valuable franchise, by means of which franchise he might live in idle luxury at the expense of society. In short, the inventor is considered, whatever attitude toward him be professed, a privileged seeker, a delver into the "pork barrel," a monopolist, and a blackmailing grafter.

It is denied that the inventor is or can be a producer; he is considered merely a forestaller, an appropriator of natural laws in justice free to all, for that no man can produce by mental exercise alone.

This inventor, who may be without hands or feet, says to society, after sitting for years in exhaustive thought, "I have produced a mechanical design which, expressed materially in the form of a machine, will save the labor of a thousand men, enriching society by the labor saved. What will you give me to disclose it, and how will you guarantee payment?"

Society at present replies: "In the first place, you are a liar; you have produced nothing, for you have neither hands nor feet to produce with. Secondly, you are a thief, because you have appropriated and hold secret possession of our natural rights, but, as we know no means by which we may forcibly dispossess you and recover these our rights, and as we greatly desire possession of them, we will agree to pay your blackmailing claim, by granting you a patent right upon the design."

But, if the inventor cannot produce without limbs, how can he steal without them, and what thing economically has he stolen from society?

If all the wheat or cotton be gathered into the possession of a Patten or a Sully, how can monopoly result from such concentration, the wheat or cotton being a labor product, and therefore property? How can more than temporary inconvenience result, provided the land from which the wheat or cotton was produced be still accessible to society for the production of a further supply of the desired product?

Thought, applied to language, produces word combinations or literary designs, for the expression of opinions or ideas. Unless title to *language* be conferred upon an individual, so that he alone may produce literary designs, how can monopoly result from any individual possession of copyrights on these literary designs, which rights concern a labor product?

Thought, applied to the laws of mechanics, produces mechanical designs, which expressed materially are valuable to society. Unless title to the *laws of mechanics* be conferred upon an individual, so that he alone may produce mechanical designs, how can monopoly result from individual possession of patent rights on these mechanical designs, which patent rights concern a labor product?

A chemist burns the midnight oil in useful research for fifty years while his fellows carouse. Feeling his energies weaken, he writes the results (in a few hours perhaps) of his years of study, copyrights, and rests from labor upon the sale of his book. There are many—even millions of—people sufficiently hardy to deny that this writer is a producer, and to assert the equal right of the public to publish and sell this man's book without payment to him.

The inventor, whose is undoubtedly the most exhaustively consuming and poorly paid of labor, he being wellnigh universally a loser physically and financially, produces his mechanical design by years of conscientious, grinding, slavish mental toil and financial expenditure, while the public idly await his product, whereupon these latter, too lazy to produce their own designs, or too graftingly dishonest to acquire them by purchase, proceed to slanderously declare him a grafter and to actually demand equal rights with him in the use of his product.

I must deny that the inventor is a grafter, and that a patent monopoly ever existed or is possible of existence while the basic laws of mechanics are maintained freely accessible to society for the production of mechanical designs.

If Congress, therefore, in well-intentioned ignorance, or at the behest of selfish interests, legislates away from the inventor his property rights into the hands of nonproducers, Congress will be guilty not alone of confiscation, but of the very worst sort, because confined to a particular class.

It will discourage unto death the inventive art, the most useful of arts, and when all too late, society will realize that in thus socializing the product of the inventor's toil, greed has at last burst the bag.

Newark, N. J. J. H. RUSBY.

"Snow-rollers"

To the Editor of the SCIENTIFIC AMERICAN:

The little article "Wind-rolled Snowballs" in your issue of March 1st is an interesting contribution to a subject with which meteorologists are tolerably familiar, but apparently the scientific world at large is not. Snowballs of the character described are known technically as "snow-rollers." (See the Supplement to the Century Dictionary.) It is likely that some of your readers will be glad to be referred to further literature on the subject.

The most extensive account of snow-rollers in the English language is that given in the *Quarterly Journal* of the Royal Meteorological Society, vol. 34, 1908, pages 87 to 96. This is mainly a compilation of accounts of the phenomenon previously published in scientific books and journals, and is illustrated. Some of these accounts appeared in the *Monthly Weather Review* (published by the U. S. Weather Bureau).

Probably the most important contribution to the subject of snow-rollers is the article "Schneewalzen," by Rudolf Meyer, in *Korrespondenzblatt des Naturforscher-Vereins zu Riga*, vol. 52, 1909. This gives a list and analysis of all cases known to the writer between the years 1808 and 1909, and is accompanied by a bibliography which lists 35 previous papers on the subject, in several languages.

Snow-rollers were observed in Morris County, N. J., in January, 1809, by Rev. D. A. Clark, when it is stated that "the whole landscape was covered with snow-balls, differing in size from that of a lady's muff to the diameter of 2½ or 3 feet, hollow at each end to almost the very center, and all as true as so many logs shaped in a lathe." C. FITZHUGH TALMAN,

Washington, D. C. U. S. Weather Bureau.

"Uncle Sam's" Appraisers of Merchandise

How Imported Goods Are Examined by Experts to Determine the Duties They Should Pay

PERSONAL liberty in the United States is so complete that we scarcely realize there is a powerful central government to watch over our destinies and make us comport ourselves with proper regard for the rights of citizens in our neighboring States. Frequently, an American's first real contact with Federal power comes on his return from a trip abroad, when he is advised that he must pay duty on goods that he has brought with him. He may have looked with contempt on the poor foreigner who must submit to the pettifoggery of an officious government, and he may be returning with a smug "better-than-thou" attitude, only to receive a rude shock to his complacency as the customs officials board the vessel and make him swear out a statement of his dutiable personal effects. Then, no matter if he does consider it an invasion of his rights as a freeborn American citizen, he must submit to having his trunk opened, and searched more or less perfunctorily, to make sure that he has not perjured himself. He may even be called aside to answer searching questions about a certain piece of jewelry. Now, how did Uncle Sam know that he had that trinket? For the first time he is aware of a spy system, not unlike that of Russia, which reaches out beyond our shores to foreign lands and keeps track of the purchases of the American tourists. Despite the humiliation of being treated as a smuggler, he cannot help but feel a great respect for the omniscience of a government whose existence he barely realized up to that moment.

Although examination of travelers' baggage is the most troublesome work that the Custom House has to deal with, it is a paltry business compared with the collection of duties on general merchandise. The total amount of duties collected for the year ending June 30th, 1912, on articles entered for consumption was $304,899,366.98. Just how much of this came from the traveler is not reported, but obviously it was a small percentage. Also it is equally obvious that the cost per dollar of collecting this duty must have been very great as compared with that on general merchandise. And yet, despite the far greater attention to personal baggage, smuggling still continues among tourists, especially those of the gentler sex, who display remarkable ingenuity in concealing their dutiable goods. One customs official hopelessly admitted that "women are born smugglers, and we cannot hope ever to suppress them."

As for general merchandise, the opportunities for smuggling are so remote, the co-operation between the Government and the importers themselves is so complete, and the penalty for smuggling is so severe as compared with the reward it offers, that practically no goods enter the country without paying duty. Take diamonds, for instance, which one would suppose could very readily be introduced into the country because their value per size is so enormous. Not only does the Government keep track of purchasers of diamonds abroad, but the dealers do as well, and they are constantly on the lookout for smuggled stones, realizing that it is to their own interest to report any stones introduced without paying the required tariff. Furthermore, to make it unprofitable to smuggle the stones into the country, the tariff on them was reduced several years ago from 25 per cent to 10 per cent.

Some idea of the enormous amount of work involved in keeping track of the goods that enter this country may be obtained by a visit to the Appraisers' Stores on the lower west side of New York. The building is ten stories high and takes up an entire block, while across the street is an annex of no mean size. In these buildings at least 10 per cent of everything that comes into New York from foreign ports must be examined. During the year 1911 close to 700,000 cases of merchandise, representing merchandise worth a billion dollars, passed through the Appraisers' Stores, and the goods varied all the way from a toothpick to an automobile, and from a rare tapestry to a dead-Chinaman's queue. A sample of literally everything under the sun finds its way at one time or another into the Stores, and no matter what its character may be, whether a fifty-karat diamond or a penny doll, it must be gravely considered and its value accurately and scientifically determined, so that the proper custom duty may be levied thereon. To handle this enormous quantity of material engages the attention of 938 men, of whom 134 are examiners. The duties of the examiner are exceedingly difficult. Each man has a certain classification assigned to him, and he must be prepared to determine the wholesale value of any of the various articles that might turn up under that classification. He must be able to tell of just what material or materials the article was made, how much the materials were worth in the market from which they came, and just what was the value of the labor which was expended upon it. Not only that, but he must know the market values of the materials and labor at the time of shipment. This must be determined on his own knowledge and not on the word of the shipper. He cannot depend on anyone else, but must stand on his own statement, which he must be ready to back up with incontestable evidence in case the importer carries an appeal to a higher court. He must be able to detect all the tricks with which unscrupulous manufacturers delude the ignorant public. For instance, in the textiles department, the examiner must be able to tell whether a piece of goods contains cotton, linen, or silk, and in what proportion. Having determined this, he must know the quality of the material used in making it up. If it is of silk, he must determine whether the silk is artificial or natural. If natural, what kind of silk, and where it came from. If he is in doubt about the matter, he refers a sample to the laboratory, where the fabric is subjected to a chemical test in order to determine accurately what its composition may be. Naturally, an examiner acquires before long such an experience as to qualify him as an expert, an experience that it is impossible to obtain anywhere else.

Testing the color and strength of tea.

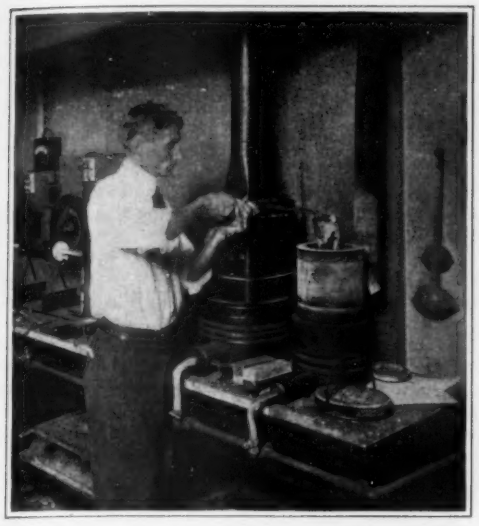
All Cuban leaf tobacco must be minutely examined.

Stamping imported cigars after they have been thoroughly inspected.

Recently, curiosities, works of art, and antiques, over a hundred years old, have been admitted free of duty. When the tariff was removed on such objects, this country was immediately flooded with all sorts of curios from every known part of the world, and the poor examiner had to determine whether these objects were at least a hundred years old. When we consider that the articles came from the most remote regions, we can readily understand how difficult was the work. Possibly the most interesting work in this connection is that of determining the age of old furniture. Professionals as well as amateur collectors are duped by clever imitation, and frequently it is not until the examiner in the Appraisers' Stores determines the period to which the article belongs that the purchaser discovers that he has been swindled. Usually the examiner can tell at a glance to what period an article belongs. He is not fooled by artificial weathering, or by bird-shot fired into the wood in order to give it a worm-eaten appearance, but he is puzzled sometimes when he finds that around a small portion that really is antique, parts of a more recent date have been applied, or modern wood and varnish have been used to restore a wrecked piece of old furniture.

The examiner who has to appraise the work of artists has an exceedingly difficult task. In many cases it is not at all easy to distinguish between spurious and genuine old masters. The work of these examiners is of undeniable value to the country in preventing the importation of counterfeits.

Similar protection against fraud is found in the case of tea. No duty is levied on tea, but all tea must be examined for purity before being admitted into the country. In the tea room of the New York Appraisers' Stores a hundred thousand samples of tea must be tested per year, which represents an import of about



Assaying an alloy in the metallurgical laboratory.

Testing sugar solutions with the polariscope to determine percentage of cane sugar.

Decolorizing and filtering sugar solutions for polariscopic test.

forty-five million pounds. One of the photographs shows the manner of testing. Each cup contains a different sample of tea identified by a number marked on the bottom of the cup, and one of the cups contains a standard sample. Which one it is the examiner does not know, for the identification of this sample also is marked on the bottom of the cup. The examiner then proceeds to arrange the cups according to the color and taste of the tea. After the grading is done the samples are thrown away and the cups turned upside down to show the identifying numbers. All the samples on one side of the standard are passed as good tea, while those on the other side are rejected. To make sure that no error has been made the test is repeated with a second set of samples. In order to detect any pigment used in the tea the leaves are mashed on a piece of white paper, and then the paper is examined with a microscope for faint spots of coloring matter. The tests are very rigid and thorough, and the United States may pride itself on having nothing but pure tea to drink.

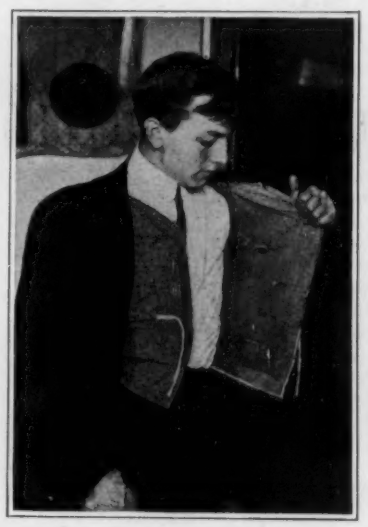
Perhaps the most tedious work at the Stores is the testing of sugar. The tariff on sugar depends upon the proportion of cane sugar the samples contain. This is determined accurately by means of a polariscope, which analyzes the light that passes through samples of the sugar syrup. When a beam of light is passed through a Nicol's prism the transmitted light vibrates only in one plane. When this polarized light passes through the syrup its plane of vibration is distorted to a certain extent depending upon the quality or nature of the syrup and on the length of syrup it must pass through. By comparing this distortion with a certain standard it is possible to tell just what proportion of cane sugar is contained in the syrup. To prepare the samples for the polariscope fixed quantities of sugar must be carefully weighed, dissolved in a measured quantity of water, filtered and decolorized. The work is very wearisome and trying, with no variation to relieve the monotony. In the case of sugar only samples are brought to the Stores, and as a check upon the examiner, two samples out of each barrel are given him. Each sample bears its own number, but the examiners have no means of determining which two came out of the same barrel. Nevertheless, his work must be so accurate that when like samples are paired again the readings will be practically identical.

The laboratories of the Stores are also kept busy with quantitative analyses of various chemical products, particularly in the search for alcohols in medicines, etc. There is also a section devoted to metallurgical analyses.

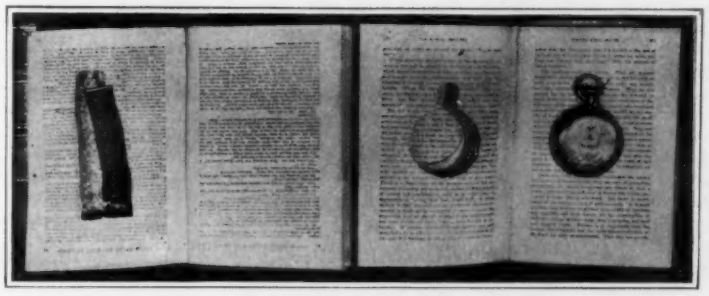
Obviously it would be impossible to examine every article imported into the country, and so it is the practice to bring at least ten per cent of a shipment to the Stores. If the shipment consists of but one or two cases of goods at least one case must be examined. The cases that go to the Stores are picked out at random by the examiner. He compares the contents of the case with the invoice and then investigates one of the articles under the invoice minutely in order to determine its quality. If this tallies with the specifications the case is passed. In certain classes of goods, however, the entire shipment must be minutely scrutinized and appraised. In the case of leaf tobacco, for instance, every package must be opened, in order to determine whether the leaves are good enough to be used for wrappers which must carry a duty of one dollar and eighty-five cents per pound, or whether they are fit only for fillers, which pay thirty-five cents duty. Certain classes of tobacco which are obviously inferior do not come in for such careful examination, but in the case of Cuban tobaccos, a hundred per cent must be brought to the Stores. In the appraising of cigars, a very careful count and estimate of weight and value must be obtained; for not only must the tariff be collected, but the boxes or bundles must pay a tobacco tax.

We cannot go into all the details of the work at the Appraisers' Stores, but we have mentioned enough to show that it is of a most exacting nature. We must also pay a tribute to the high character of the men employed in this work. It is hard to understand how the Government can afford to hire so many experts. As a matter of fact the salaries are not at all proportionate to the experience and quality of work. Frequently an examiner steps out of the Stores into a position with some manufacturer at a salary many times greater than that he has been receiving from the Government. However, as a rule the men are content to stay in the Appraisers' Stores because they become devoted to the work, and find it full of never-ending interest.

Analyzing drugs and medicines for acids, alkalies, oils, etc.



Smuggler's vest, thirty-six pockets for watches and jewelry.



How the smuggler conceals dutiable goods in books.

Examining cases of drygoods.

Artificial Marble

THE following are directions for making artificial marble: 1. Burnt gypsum is saturated with a solution of lime in alum water, burnt again, ground finely, or rather pulverized, adding 1/12 by weight of the gypsum of alum; and cast in the mold. These harden very slowly, but attain the hardness and transparency of marble. Different pigments may be added to obtain different colored marbles. 2. Pieces of burnt gypsum, the size of a fist, are put for 3 hours in a 12 per cent solution of alum in water of a temperature of 85 to 104 deg. Fahr., burnt again, pulverized, adding 1/16 powdered alum, and lastly worked into molds with water containing 1/16 sal ammoniac for each part of gypsum. Castings made of this combination possess great hardness and brilliancy, and it may, therefore, be used for fine statues.—*Neueste Erfindungen und Erfahrungen.*

Power from Kerosene

A System Whereby Oil, Kerosene, and Distillates are Used in the Ordinary Type of Gas Engine

By L. W. Ellis and W. R. Dray

THE intelligent public has been slow to adopt the oil engine. It has been educated by use to internal-combustion engines which make an explosive gas out of cold gasoline. Through its familiarity with the automobile, it has come to demand an oil engine that follows established gas engine practice. Probably the greatest single factor in such distinction as John A. Secor has earned is his early formulation of the *doctrine* that the oil engine need not and must not vary in principle from the gas engine. Second only to that, however, ranks his discovery of the *means* for using oil without sacrificing a single desirable feature of the best gas engines. His work, which is just beginning to have world-wide recognition, offers an answer to the general demand. The following article, abstracted from a longer article appearing in the February 15 issue of the SCIENTIFIC AMERICAN SUPPLEMENT, explains the principle of the invention.

The Secor patents do not apply to engines which differ from the familiar gas engine type, such as the Diesel and the vaporizing type, nor to the type using the hit-and-miss governor. They are applicable to the throttle-governed engine only.

Stated concisely, the Secor system covers, (1) an automatic variation in the quantity of fuel mixture in accordance with the slightest variation in speed and load; (2) a degree of compression dependent upon the quantity of the mixture inhaled; (3) a correct proportioning of the mixture under all conditions, involving relatively weaker mixtures for the higher compressions and increasingly stronger mixtures for the lower compressions; (4) a temperature of combustion exactly adapted to the quality of fuel used and the compression; (5) automatic control of the internal temperature through the admission of water as a part of the fuel mixture; (6) thorough and uniform mixture of the fuel, water and air charge by mechanical means and without the application of additional heat; (7) automatic variation in the time of firing in response to variations in the speed and power; (8) means for changing the limits of rotative speed within which all factors are simultaneously controlled; (9) and means for starting on a limited supply of volatile fuel—all of which factors are vital to the control of internal heat, the transformation of heat into power, and power production. These features are now embodied in commercially successful engines which have been adapted to a great variety of stationary and traction work.

One great factor in the success of the system is that through the mechanism of the Higgins carbureter, the proportions of fuel, air and water are automatically varied in relation to each other as the compression changes. By this means the conditions within the cylinder, whether the engine is run at heavy load or light, are constant so far as they affect the completeness of combustion. Complete combustion eliminates the deposit of carbon, which has been regarded as an insurmountable objection to the use of heavy fuels, and the unified automatic control results in the securing of splendid regulation.

Crank shaft, cam shaft, governor, magneto, carbureter, valves and piston act as a positively controlled unit in engines equipped with the Secor system, hence no one mechanical factor deserves to be set apart from the others in importance. However, the Higgins carbureter, which makes possible the application of the Secor system, is of sufficient novelty to warrant especial attention. Fig. 1 shows the top view of a two-cylinder tractor motor equipped with the Secor-Higgins system. The cam shaft is gear driven and in turn drives both governor and magneto through bevel gears. The fly-ball governor, through a first-class lever and a link coupling, operates a sliding brass plate which is clearly shown in Fig 2. The carbureter sits above the cylinders, with the short inlet manifold presenting little opportunity for the mixture to stratify before it is completely vaporized. It contains constant-level chambers for kerosene and water, an over-flow being provided for each. It has also for starting purposes a chamber for gasoline which is filled by hand pump. This chamber, which holds about a pint, is connected by a siphon with the mixing chamber. Turning the engine over creates suction enough to draw upon the contents of this chamber, but a vent is provided so that if a start is not made immediately the siphon will not continue to act and drain the chamber.

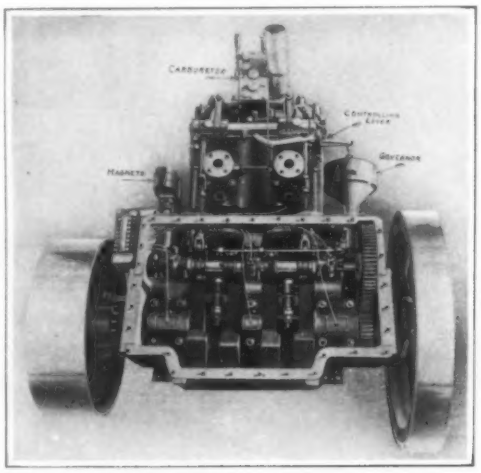


Fig. 1.—Top view of two-cylinder motor equipped with the Secor-Higgins system.

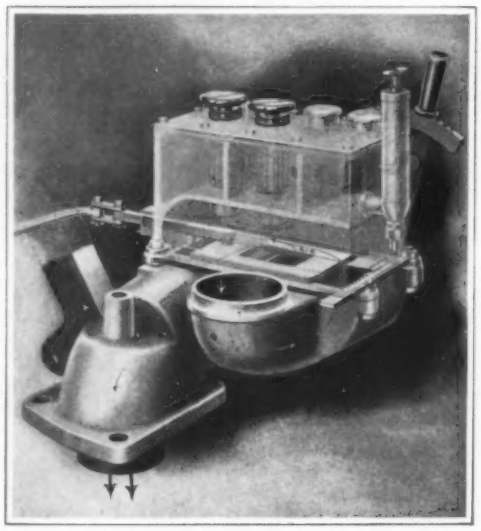


Fig. 2.—Higgins carbureter, showing air intake and manifold.

Fig. 3 shows the position of the valve plate at light load. Two air inlets are then open, providing a large ratio of admission to outlet area and thus greatly reducing the relative vacuum in the mixing chamber. As the load increases, the governor throws the sliding valve forward, increasing the area of the outlet to the cylinders, increasing the air inlet in the middle, and decreasing or entirely closing the air opening at the right. Thus the ratio of admission to outlet area decreases, the relative vacuum becomes greater, and more fuel in quantity, though not in proportion, is picked up by the incoming air and carried to the cylinder.

A sectional view from the side (Fig. 4) shows the arrangement of the kerosene and water needle valves, the overflow, etc. It will be noted that the water level is lower than the kerosene level. The suction, therefore, is not great enough, until the engine reaches about half load, to lift the water to the point (H2) where it can flow down the tube surrounding the needle valve. From half to full load, the ratio of water to fuel increases rapidly until the amounts of fuel and water used are practically equal.

The carbureter is so designed that the fuel needle valve *K* should be adjusted at the full-load position, when the plate is farthest to the right. This order of procedure is important, since at this position the adjustable plate has no effect upon the area of the air inlet openings. The adjustment of the air should be made at the "no-load" position, and after once made need never be changed, unless the engine enters a very different altitude. This adjustable plate allows each carbureter to be adjusted to the engine it is to serve, hence the slight variations in manufacturing are fully taken care of. The sliding valve is the only moving part in the carbureter, and that is positively controlled. There are no springs, floats, or check valves. Wear cannot affect the size of the air openings which control the relative vacuum in the mixing chamber, therefore, the accuracy of the carbureter will never be interfered with by any ordinary cause.

Ignition is necessarily electric, and in large engines, where the speed variation is great, means have been developed for automatically advancing the spark as the speed increases. On ordinary engines, however, only such manual adjustments are needed or provided as will take care of the starting and normal speeds.

One of the most noted gas engine builders in the country has adapted this system to a line of stationary kerosene and distillate engines which will eventually range in size from 50 to 170 horse-power. His factory tests show an efficiency of over 15 brake horse-power hours per gallon of kerosene on 50 horse-power single cylinder engines at all loads from about one third to shortly below the maximum. The manufacturer's literature places a guarantee of within 2 per cent on speed regulation. One other large licensee making stationary engines in sizes from 3 to 15 horse-power is achieving considerable success through a series of electric lighting and power outfits suitable for the country home or small business. The generators are direct-connected, yet give steadier power than the average public service in the smaller towns. The U. S. Government is using a number of engines fitted with this system to drive air compressors for foghorns in life-saving stations on the Great Lakes.

A six-cylinder marine engine using the Secor-Higgins

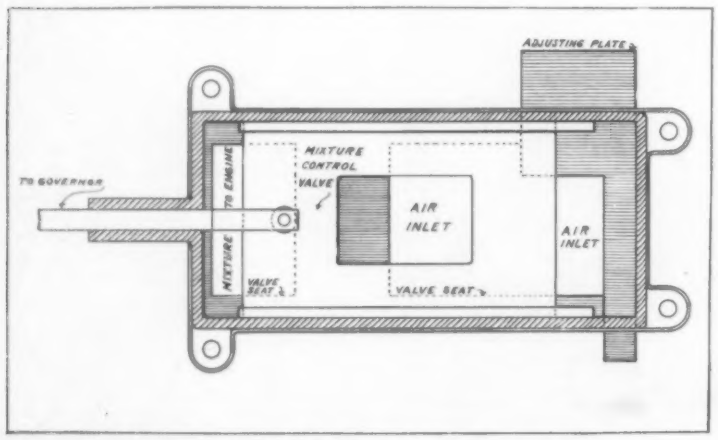


Fig. 3.—Position of sliding valve at light load.

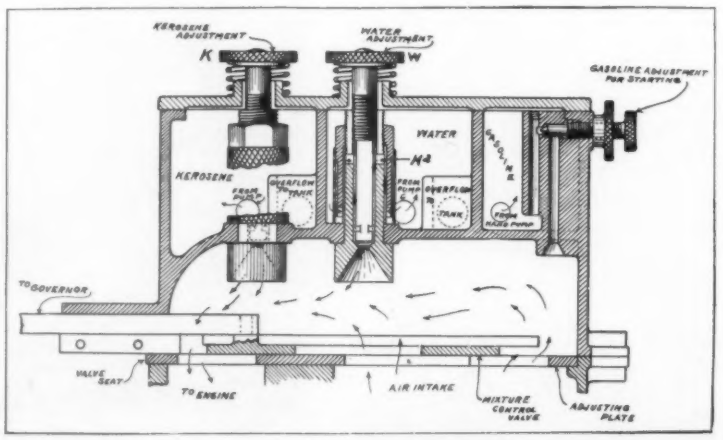


Fig. 4.—Longitudinal section of carbureter.

system develops a brake horse-power hour from 0.9 pint of kerosene. A large number of Secor engines are being used by the Japanese government for operating electric lighting and wireless telegraph stations, and these engines have been adapted to a great variety of uses in this country, where safety and close speed regulation are essentials. Naturally, insurance rates are much lower where a non-volatile fuel is used.

The widest use of this system, however, has been made in connection with farm tractors. One factory built more than 50 tractors a week as an average for the year 1912. These engines are meeting with universal success, operating on the kerosene and distillates of the United States, on gasoline in South America, and on the lighter grades of crude oil found in the United States and Southern Russia. A two-cylinder tractor, 10-inch bore by 12-inch stroke, running at 375 revolutions per minute, recently developed in an official contest at Winnipeg, Manitoba, 51 brake horse-power in an economy test with a consumption of 0.71 pound of fuel per horse-power hour, and 76.5 horse-power in a maximum test on 0.85 pound of fuel. This is a grade of fuel which sells at 5½ to 7 cents in barrel lots in country towns throughout the Central States, and weighs nearly 7 pounds to the United States gallon.

In the Winnipeg Motor Contest of 1911, a single-cylinder engine of the same type averaged 0.85 of a pint of fuel per brake horse-power hour on kerosene and 0.93 of a pint per brake horse-power hour on gasoline. The kerosene contained 16 to 20 per cent more heat units than gasoline, hence the engine running on kerosene, while a trifle more economical as regards volume of fuel used, was a trifle less efficient thermally. In the last three such competitions, the fuel cost of the tractors operated under these patents has been consistently lowered and has remained at or near the lowest point recorded, while the speed regulation has been scored perfect in nearly every instance. The recent winning of a gold medal and sweepstakes over more than twenty other tractors, including four steam and fourteen gasoline, indicates that the desirable oil-burning feature has been achieved without sacrificing any points of excellence. These tractors are being used by ordinary farm hands in every condition of climate and altitude without further adjustment than is provided for in the simple carbureter.

Military Automobile Gun

By the Paris Correspondent of the Scientific American

EVER since the employment of aeroplanes and airships has become one of the recognized elements of modern warfare, attention has been called to the question of cannon for firing upon objects of this kind, and naturally a combination of an automobile with a suitable gun for use in firing at high elevation is sought for. In France where military aeroplane questions are actively taken up at present, designers have been working upon an automobile cannon of this sort, and we here present the most recent and successful type which comes from the De Dion automobile works, the construction having been carried out according to plans furnished by Capt. Houberdon and other army officers belonging to the engineering corps. The automobile is made as light as may be compatible with the load which it is designed to carry, as the car is required to run at a good speed, and to carry this out a good-sized 4-cylinder motor is used. On the rear end of the chassis is mounted the cannon with all the proper devices for the firing at a high angle. A turntable base which can be rapidly rotated so as to secure a rapid aiming of the gun is here employed, and another device allows the gun to turn upon its trunnions, the height being regulated by a toothed sector and gearing operated by a hand wheel. All the movements are rapidly carried out, as is required for directing the gun upon objects in the air. When running on the road and out of use, the gun is let down so as to come into the horizontal position, and lies close to the base. During the firing, it can take all inclinations up to 70 degrees, and in this way it fires almost vertically, as our engraving shows. The new automobile gun is meeting with favor in the army, and it has already shown a very good performance in the military maneuvers.

Recent Improvements in the Storage Battery

THERE are about fourteen hundred patents in the storage battery art, as granted by the United States Patent Office. A still larger number is found in the foreign patents. The casual observer might assume from this that there was nothing left to be desired in the battery or that there was no room for further large improvements. On the contrary, the perfect storage cell has yet to be discovered. However, the present day form of cell is steadily, although not spectacularly, approaching perfection, limited, of course, by certain inherent qualities that cannot be overcome.

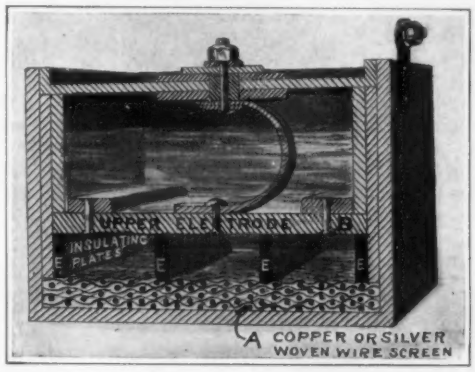


Fig. 1.—Morrison's zinc lead-dioxide cell, showing screens A of copper wire.

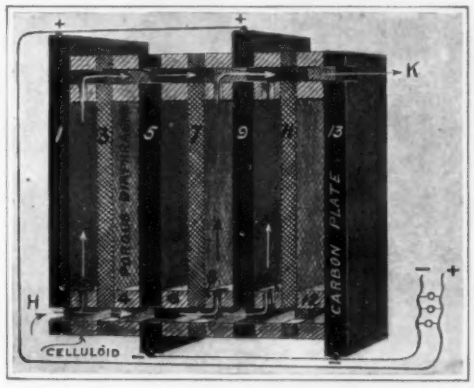


Fig. 2.—Structure of cell used in Basset's electrical battery.

The Lead Storage Cell: In the lead storage cell alternate plates of spongy lead and lead dioxide, separted by insulators, serve respectively as negative and positive pole electrodes in an electrolyte of sulphuric acid. Upon discharge, the lead is oxidized and the dioxide reduced, the resulting products uniting with the acid to form lead sulphate. Upon charging, the reverse reactions occur. Due to these molecular changes, the active materials expand and contract. Herein lies the main difficulty in making a battery that will "stand up" under the stress of usage. The oxides being poor electrical conductors and loosely adherent, a metallic support is essential. The vast majority of patents deal with the structures of such supports. Either a lead oxide paste is applied upon a metallic grid or is held in a perforated container, according to the Faure method, or the active material is electrolytically "formed" *in situ*, upon a plate generally comprising thin closely spaced leaves of lead, by the Planté process of alternately oxidizing and reducing the plate.

Expanders: Active material, where exposed on the exterior of a plate, tends to flake off or disintegrate. Of the various expedients to obviate these difficulties, the use of a so-called "expander" is most common. That is, the active material is impregnated with a finely divided, inert, insoluble substance, often an electrical conductor. For example, Rodman soaks the dried plate in barium nitrate solution and then dips it in sulphuric acid, thus precipitating insoluble barium sulphate within the pores of the electrode. He also subjects a plate of barium-lead alloy to anodic oxidation in sulphuric and nitric acid, thereby forming lead dioxide and setting free the barium, the latter being then transformed to a sulphate. Ford soaks his plate in a tannin solution containing deflocculated graphite in suspension. Morrison uses oxygen compounds of chromium, tantalum, niobium or tungsten. For example, he electrolyzes the ordinary lead dioxide plate as an anode in a sodium tungstate solution, thereby forming a tungsten oxygen compound within the pores of the electrode. Morrison also describes the use of such agents as nitro-celluloses, especially celluloid, or rubber vulcanized in the plate.

Initially Formed Active Material: Salom works on the problem from another viewpoint. He first electrolytically forms, or as it were, "charges" the spongy lead or lead dioxide, so that it is initially fully expanded, and then applies it to the grid under hydraulic pressure. The spongy lead is bonded by allowing water to evaporate from the powdered lead crystals, thus oxidizing it superficially throughout.

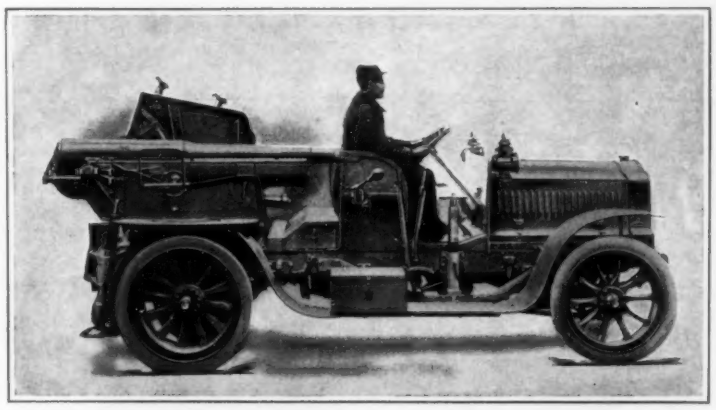
Quick Discharge: An essential for a quick discharge is that the pores in the active material be so large that the acid does not become impoverished at the working surfaces. This has been accomplished by mixing the lead oxide paste with various compounds, which are dissolved when the plate is formed, such as sugar, salt, various silicates, carbonates, etc., or powdered metals, such as zinc dust. Marino specifies an aggiutinant of glycerine, soluble starch and water glass. Others make up a Planté plate of a lead alloy, such as lead-zinc, and afterward chemically or electrochemically dissolve the zinc or other alloying metal.

Hannover in Denmark casts a plate from a mixture of a metal and an alloy, e. g., of lead and antimony, applies heat until the eutectic alloy becomes fluid, while the remainder is solid and then squeezes out the fluid particles, leaving a spongy plate. He then galvanically precipitates metal of a higher melting point within the pores, heats and melts out the original material.

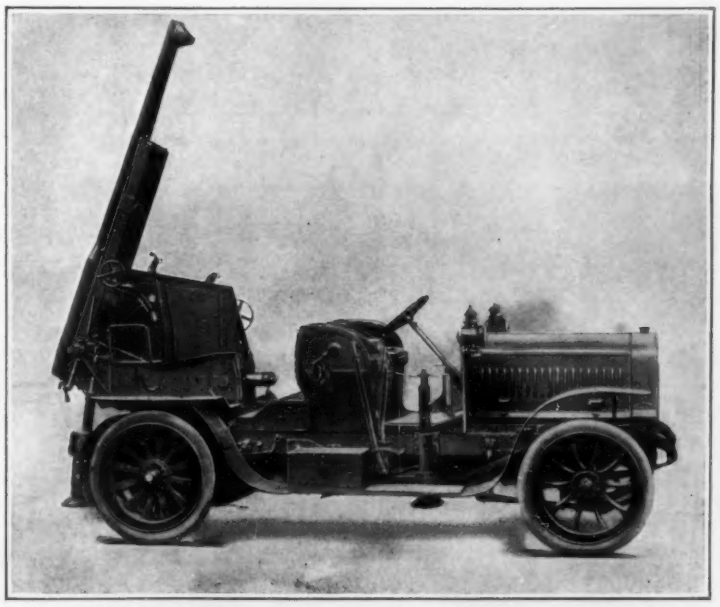
Tate accomplishes the same end in a bifunctional electrode, made up of interleaved strips, alternately positive and negative, and suitably separated by porous earthenware plates, which carry a supply of acid. Each strip is about one half inch wide and the active material is but one thirty-second inch deep, thus exposing substantially the whole mass to the electrolyte.

The Iron Nickel Cell: The iron nickel

(Concluded on page 256.)



The automobile gun on the road and out of use; comes into horizontal position and lies close to the base.



The automobile gun during firing can take all inclinations up to 70 degrees.

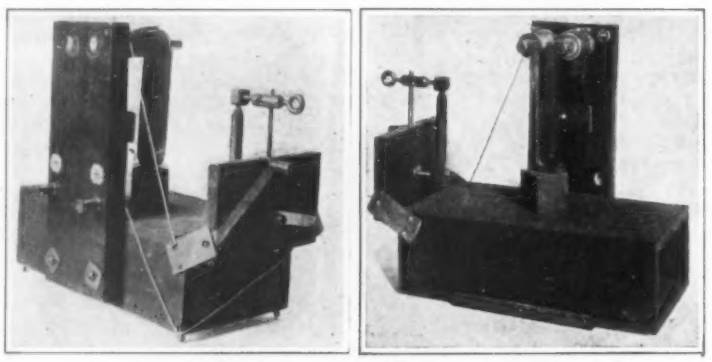
Ice-boating

A FEW weeks ago we described the exhilarating sport of motor ice-boating, and showed some of the more substantial types of motor-driven sleds. One might be tempted to think that the motor ice-boat would eventually render the wind-driven iceboat obsolete. Such, however, is hardly likely to be the case when we consider the rare sport that can be obtained with the wind propelled vehicle. The accompanying photograph shows an exciting moment in an ice-boat race. The ice-boat is "lifting" to an alarming angle, and it seems as if it must surely topple over; but it will right itself and continue on its course. Surely a sport affording such exciting moments is not liable to die; for ice-boating is purely sport, and there is no utilitarian reason for introducing motors as has been the case in sailboats. The only reason for the motor ice-boat is that it affords a different kind of sport. The two types of ice vehicles will surely be continued and developed side by side.

An ice boat "lifting" to an alarming angle.

The Micro-monophone

THE micro-monophone is a tuning fork kept in permanent vibration by means of a microphone contact. This is an improvement over the familiar tuning fork interrupter for the reason that its sound is much clearer, while the current curve approaches much more closely to a sinusoidal form. Two views of the apparatus are shown herewith. The tuning fork is mounted upon a resonance box. The prongs of the fork are situated in the field of an electro-magnet on which is superposed the field of a permanent magnet. The coils of the electro-magnet are arranged in series with a microphone mounted at the closed end of the resonance box. The support for the microphone is such that it may be moved to bring the lower carbon electrode into contact with the resonance box. When current from a battery is passed through the microphone and the electro-magnet, and the tuning fork is set vibrating by means of one or two slight knocks, vibrations will be transmitted through the resonance box to the microphone producing variations in the magnetic field of the electro-magnet, which in turn acts upon the tuning fork and keeps it vibrating. Thus we have a complete cycle of operation, the tuning fork keeping the microphone in operation, and the latter by means of the magnet, keeping the tuning fork vibrating. The tuning fork will then vibrate as long as the battery current is complete or unbroken. By reducing the current intensity the purity of the sound is increased.



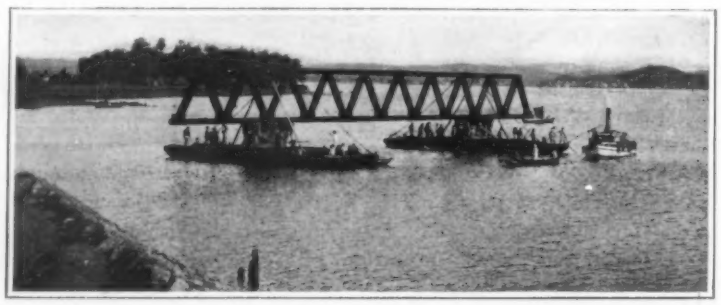
Apparatus for keeping a tuning fork in constant vibration.

Acorns and Their Uses

VERY little attention has been given in this country to the utilization of acorns. It is well known that they are used as food for cattle, horses, swine, turkeys, and those of several species of white oaks also form the food of man.

The acorns of white oaks are mostly large and the trees in general produce fruit very abundantly. The Indians in California always gathered the acorns of the California live oak (*Quercus agrifolia*); and years of great scarcity often caused much misery. Even the early white settlers of California relied on the crop of acorns as a part of their food supply. The acorns were gathered by the squaws, who preserved them by putting them in wicker baskets, which were generally stored in hollow oak trees or in caches as shown in the illustration. They were prepared for eating by grinding and boiling them with water into a thick paste, which was baked into bread. The oven consisted of a hole in the ground about 18 inches each way. Red hot stones were placed in the bottom of it and a little dry sand or loam placed over them. Next a layer of dry leaves was spread over this and the dough or paste poured into the hole until it was two or three inches deep. A layer of leaves, more sand, red hot stones, and finally earth was placed on top. At the end of 5 or 6 hours the stones had cooled and the bread, which was an irregular mass nearly black in color, was taken out.

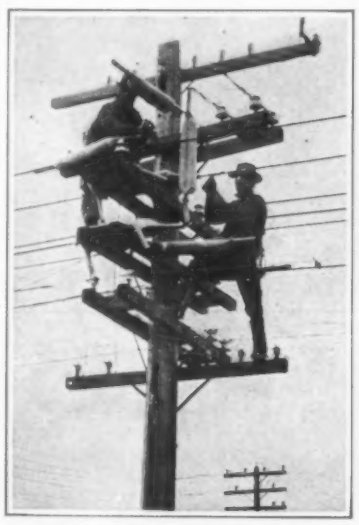
In parts of the South acorns of the cow oak (*Quercus michauxii*) have been used when roasted as a coffee substitute, and there are a good many other uses to which they might be put. Alcohol can be extracted from them, as from all starchy substances. Starch is at present made principally from rice, corn, and potatoes, but if the starch from acorns is sufficiently refined it may be employed as an article of diet as well as for laundry purposes. Acorns contain much sugar and gum, and it is probable that these substances can be profitably separated and successfully used for domestic purposes. Even the residue could be sold very profitably for fattening hogs.



Transporting a bridge girder in Southern India.

Engineering in Southern India

AT first sight there appears to be nothing very remarkable in the accompanying photograph which shows the floating into position of a large girder. The girder is a hundred and fifty feet long, and it is supported in the well-known manner upon two floats to permit of transporting it down the river. The weight of the girder is 200 tons, certainly not remarkably heavy. But closer inspection of the photograph shows a small boat on the river with a lateen sail, and in the foreground a dugout canoe, which gives us the hint, at once, that the girder is being transported on some Oriental stream. It seems rather incongruous, does this introduction of a bit of western engineering in the picturesque Oriental stream. The girder is being floated down the Netravati River at Mangalore, Southern India, over which waterway a bridge is being built. Although the transporting and placing on its piers of such a girder is a simple matter in our land, it is no inconsiderable feat where ignorant native workers must be relied upon.



Protected by shields in a network of high-tension wires.

Standing on the shields while fixing an arc lamp.

Rubber Shields for Linemen

OF the millions of people employed daily about exceedingly dangerous tasks, few are subjected to greater danger than the linemen employed by the thousands upon thousands by electric lighting and power companies. These men daily place themselves in the most hazardous positions among high-tension wires. For the protection of this class of employees a rubber shield has been invented.

The shield has the form of a rubber trough. It is used in all possible positions where the body of the operator may be exposed, and is also used as a means of protection in trimming arc lamps and repairing broken wires from the ground. In the latter case, if the weather is dry, the shield is simply stretched upon the ground for the repairman to stand upon, but in case of wet weather when this insulation is not sufficient the shield is closed at the flaps.

The appliance is manufactured of pure Para rubber, three layers of the rubber being used to two layers of canvas, the latter alternating with the rubber sheets. The second layer of canvas used is laid crosswise to the first layer, and in this way adds greater strength to the shield. The thickness of the rubber varies from ⅜ inch in locations where it is liable to be subjected to pressure to 3/16 inch along the closing flaps. The contrivance is fastened to the wire by two hard rubber rings. These are slotted with an aperture sufficiently large for the wire to enter and then clamped by this means firmly to the wires from which the lineman must be protected.

Each shield is subjected to a test of 30,000 volts submerged, but it is recommended that the protector be used only with voltages not exceeding 10,000.

It will also be noticed that this new life-saver fits over the insulators, and in fastening it to the wire the lineman grips the rubber handles attached to the outside ends of the shield in such a manner that it is between his hands and the wire.

How the Indians in California store their acorns for winter use.

Inventions New and Interesting

Simple Patent Law; Patent Office News; Notes on Trademarks

A New Gear Engine

TWO small spur gears cutting through a steam chamber at their intermeshing point—this is practically all there is to an engine, which has recently been tested at the laboratory of Columbia University, at the power house of the New York Central Railroad, and at the Chicago and Northwestern power house, where it developed thirty-five horse-power with better economy than the average multi-stage turbine or piston engine of equal power.

The construction of the engine is shown in the accompanying drawing, in which the two gears *A* are mounted in a suitable casing *B*. At their intermeshing point there is a centerpiece *C*, containing two steam chambers, for this is a reversing engine. The dotted lines *D* and *D*¹ outline the chambers, and they communicate with the pipes *E* and *E*¹, respectively. When steam is admitted through the pipe *E*, it fills the chamber *D* and can escape therefrom only by propelling the teeth of the gear wheels in the direction of the arrows. The escaping steam fills the casing *B*, and most of it escapes through the exhaust *F*. Some of the steam is carried by the teeth into the chamber *D*¹, and escapes through the pipe *E*¹, which is connected with the exhaust. When it is desired to reverse the engine, the pipe *E* is connected with the exhaust and steam is admitted to chamber *D*¹ through pipe *E*¹. Such is the construction of the single stage type of engine. Very evidently the parts may be duplicated to produce a multi-stage gear engine.

The following is a report on the engine tested at Columbia University Mechanical Laboratory and the New York Central Power Station:

"The results show a very good water rate for this size of unit. The engine has the following salient points of design: Speed may be varied over a wide range. Weight per horse-power and floor space per horse-power are very low. No foundation is required for this size unit; the machine tested was operated without vibration under load up to 4,000 revolutions per minute, standing on a wooden bench. There are, of course, no dead centers and no reciprocating parts. The external gears establish the running clearance of the working gears, so that there is no contact and no lubrication in the engine required. It has a high starting torque, as the full steam pressure can be utilized at the outset. The engine is symmetrical with respect to steam and exhaust, so that it can be reversed without difficulty and operates equally well in either direction. The engine is entirely inclosed, and slugs of water have no effect except a temporary slowing down. As the engine can be equipped with two pulleys revolving in opposite directions, belts can be operated if necessary on very short centers, as one pulley can act as an idler in securing additional wrap on the other pulley. It obtains its good water rate by eliminating most of the other losses which occur in small engines and turbines, such as cylinder condensation and leakage in a reciprocating engine, and windage and steam friction in turbines."

This engine easily delivered 50 horse-power on the brake, and the above figures were estimated from that basis.

Various tests have been made in the past on the single-stage unit to determine the increased economy of the multi-stage gear engine. The results of these tests have brought to light an entirely new method of expanding steam, heretofore unknown to authorities on thermodynamics. The expansive power is obtained in this new cycle while the steam is working at a continuous flow against a series of pistons, having what is termed an infinite receiver between them, which consists of merely steam passages between successive and closely adjacent stages, the number of stages determining the amount of expansion obtainable. The following is quoted from a report by Prof. Parr, based upon tests made by Prof. Pigott, both of Columbia University:

(Concluded on page 258.)

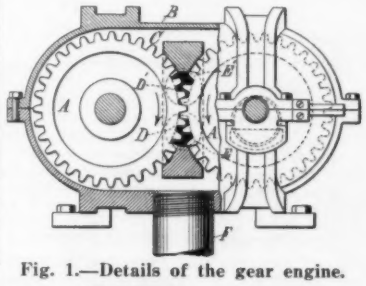


Fig. 1.—Details of the gear engine.

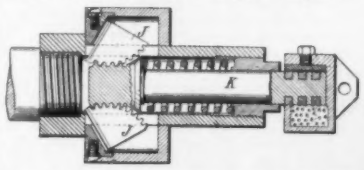
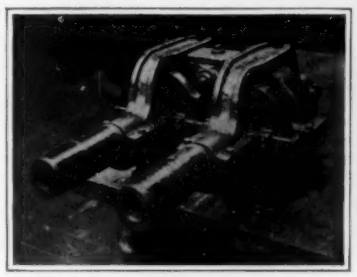
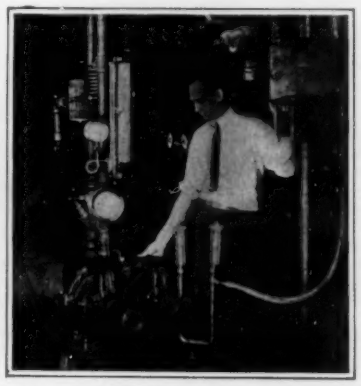


Fig. 3.—Section through the governor.



New single stage gear engine.



The gear engine undergoing a test.

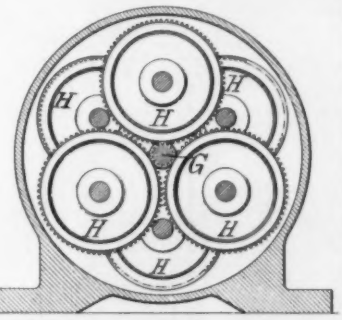


Fig. 2.—Speed reducing gear.

Fig. 1.—The first machine patented in the United States for printing railroad tickets. Fig. 2.—One of the most recent forms of printing machines, in which all tickets are numbered with one serial number. Fig. 3.—In this machine the tickets to each station are printed with their own serial number. Fig. 4 shows an improved machine with the cash register feature.

Machines for Printing Railroad Tickets

IN a large railroad system, the cost of supplying, storing and issuing tickets to passengers is no small item. In the system generally followed in this country, each station agent is required to keep on hand a stock of complete tickets for each principal station on the road and blank tickets for the less important ones, in which the name of the destination is written or printed with a rubber stamp. This latter class of tickets is always a source of trouble, as that they are subject to forgery and the liability to error in accounting. Furthermore, cumbersome ticket cases are required to hold these tickets, and in large stations such cases take up much valuable space.

In view of the foregoing facts, it would appear that a comparatively simple and practicable machine by which it would be possible for the ticket agent to print each ticket as it is called for, would receive careful consideration by the railroad companies. Many ingenious machines have been invented for doing this work. Practically all of them have a fixed plate for printing the body of the ticket, such as the name of the road, the conditions under which the ticket is sold, etc., and movable or removable type plates for the place of destination and date. They also are so arranged that at least the destination of each ticket printed is also printed on an auditing strip, which is of great assistance to the agent in auditing his accounts, and may be turned in with his reports.

In Fig. 1 is shown the first complete machine of this kind patented in this country, in 1873. A roll of paper in ribbon form having printed thereon the main body of the tickets, is placed in the lower cylindrical part *a* of the machine. The end of this ribbon passes up over a feed roller in the upper cylindrical part *b*, and thence out over the platen at the top. A curved arm *c* is pivoted at the back of the machine, and at its front are recesses for removably holding the type plates *d* for the destination and the date. At each complete revolution of the crank-shaft, the paper strip is fed forward the space of one ticket, and by means of eccentrics *e* an inking roll *f* is passed over the type plates and the arm is brought down on the platen, thus completing the ticket. The ticket thus printed is then cut off. The auditing strip lies alongside the ticket strip and is fed forward at a slower rate and the identifying matter is printed thereon at the same time the ticket is printed.

The next view (Fig. 2) shows one of the most recent forms of this type of machine. In the upper part of the casing is a horizontal shaft turned by a crank and carrying a mutilated bevel

(Concluded on page 256.)

RECENTLY PATENTED INVENTIONS

These columns are open to all patentees. The notices are inserted by special arrangement with the inventors. Terms on application to the Advertising Department of the SCIENTIFIC AMERICAN.

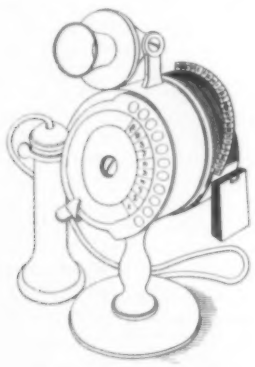
Pertaining to Aviation.

AEROPLANE.—J. ANDERSON, West Mount Vernon, Maine. This invention provides carrying planes; provides a carrying structure manually controlled to effect a proper means for facilitating the banking of the machine when turning a curve, or to regain its equilibrium; provides a car to protect the aviator and motor with the least retardation of the flight; provides an inclosed casing for the motor employed in conjunction with the aeroplane, having an exhaust duct opening at the rear to convey the sound of the exhaust away from the aviator; and provides a car body shaped to the wave line of flight to avoid the suction at the rear of a fast moving body.

Electrical Devices.

HIGH VOLTAGE STRAIN INSULATOR.—L. STEINBERGER, Brooklyn, N. Y. Mr. Steinberger's invention relates to strain insulators for high voltage electric conductors to be used in various relations and for various purposes, such as power transmission, and for guy wires or cables employed as stays for towers or for poles, masts and other supports used in wireless telegraphy and telephony, as well as in ordinary commercial work.

TELEPHONE DIRECTORY.—J. SONTHEIMER, 1446 Emerson St., Lincoln, Neb. This invention relates to telephone directories, and more particularly to a device which comprises a plurality of circular members carrying reference characters and provided with means



TELEPHONE DIRECTORY.

whereby any desired reference is rapidly found. The directory can be easily attached to a telephone, and will not interfere with its action or add much to its bulk. The invention provides a directory carrying telephone references and addresses of such parties with whom most of the telephone connections are made, and locates such references when desired with a minimum expenditure of time.

HAIR SINGER.—E. H. ELDRIDGE, care of Peoples Light Co., Corpus Christi, Tex. This singer is adapted to ease and rapidity of operation, and is characterized by a pocket adapted to receive the smoke resulting from singeing hair, thereby doing away with odors, there being a reduction of pressure within the pocket and maintained by any suitable means. The singer has a heating element adapted to en-

HAIR SINGER.

gage the hair as it is lifted or raised by means of a comb or similar article, whereby the ends thereof may be singed, the burned material and smoke resulting therefrom being carried into the pocket in the device and conducted away.

Of Interest to Farmers.

DRAFT ATTACHMENT FOR BINDERS.—H. J. DRAGER, Orlando, Okla. This invention provides an attachment supported on carrying wheels and provided with means for attachment to the body of the binder in the cutting position of the same, and with means for securing the platform of the binder upon the attachment when transporting the binder from place to place.

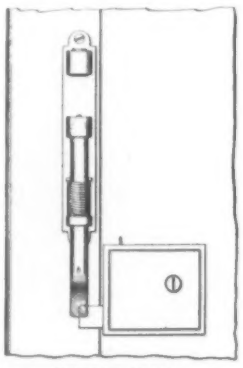
GANG PLOW.—W. L. BOATRIGHT, Glendale, and A. E. MURPHY of Columbia, Tenn. Address J. C. Voorhies, Columbia, Tenn. The object in this instance is to provide means for supporting a gang of plows in such manner that the plows will be yieldingly held spaced apart laterally, and wherein the plows may yield upwardly, and may be set to cut at varying depths, loosening but not turning the soil.

WILD OATS SEPARATOR.—A. HOILAND, Nome, N. D. This inventor provides a device having a few parts and consequently not liable to get out of order, which will quickly and effectively separate the wild oats from the cultivated oats, delivering the former at one end of the device and the latter at the other end.

Of General Interest.

TOOTHACHE REMEDY.—D. FEIGENSOHN, 1822 Madison Ave., New York, N. Y. By use of the paste of this invention in an affected tooth, quick relief of pain is had, and at the same time the paste on hardening forms a temporary filling, thus protecting the nerve and pulp against air, solid food and hot and cold liquids.

ALARM.—E. C. RICKER, Scranton, Pa. The object here is to provide an alarm device adapted to be used on either side of a door casing with doors opening in either direction. Further, to provide in a certain structure an alarm device which will give warning whenever an attempt is made to open a particular door, thereby either frightening away an in-



BURGLAR ALARM.

truder or making his capture easy. This thief and burglar alarm gives warning through the explosion of a cartridge or other explosive constructed and arranged to be set or engaged from either side of a door or opening, and particularly adapted to engage with the bolt of a rim lock and released by a push or pull from either side of the lock or other suitable connection.

SODA FOUNTAIN ATTACHMENT.—H. A. GRIFFIN, Drawer S, Rocky Mount, N. C. This invention is an attachment for spigots of soda founts for stirring and mixing the syrup or flavoring extract with carbonated water in drinking glasses, this operation being effected automatically by the flow of the carbonated water when discharged into the glasses, which have been previously supplied with a due quantity of syrup.

AWNING FIXTURE.—R. H. WEAVER, 23 Gregory St., Jersey City, N. J. This inventor provides hanging fixtures for the head bar of awnings, which may quickly be installed and removed from service position; and provides socket for hanging fixtures adapted to hold the fixtures in a substantially vertical position, to avoid the cramping of the fixtures and the rod when in service relation.

HORSESHOE.—H. K. KISO, Temple Court, 3 Beekman St., New York, N. Y. The object here is to provide an overshoe to fit on the hoof over the ordinary shoe, in order to prevent slipping or sliding on ice or wet pavements, and so constructed that the different parts may be readily attached together and to the hoof of the animal, the overshoe being so arranged that the parts brace one another and readily conform to the configuration of the hoof. This is attained by placing a reinforced pad under the hoof and fastening this pad to the hoof by means of a particular framework and straps.

Hardware and Tools.

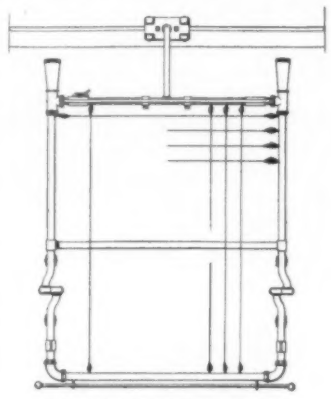
BELT BUCKLE.—L. SANDERS, 621 Broadway, New York, N. Y. It is the design of this inventor to provide a buckle in which the housing and back plate shall have such conformation and relation to each other, and such a correlation with the roller, that the roller will effectively grip a belt of any thickness ordinarily handled by the trade.

COMBINATION TOOL.—C. A. NORBERRY, P. O. Box 306, Fort Bragg, Cal. This invention comprises a miter square having a pivoted blade with a protractor attachment to indicate the position of the blade, a spirit-level and scratch-awl, a recess or notch in one edge to adapt the device for use as a center gage, and a plurality of means carried by the pivoted blade for marking a mortise on lumber, by the person using the tool.

Household Utilities.

HOLDER FOR BROOMS AND LIKE ARTICLES.—A. L. ROSS, 763 Lexington Ave., New York, N. Y. For the purpose of this invention use is made of a wire bracket adapted to be fastened to a wall on other support, and a wire bail for the passage of the stick of a broom or other article, the bail being mounted to swing on the bracket and being provided with a pin adapted to engage the stick at the rear side thereof.

FOLDING AND REVERSIBLE BED.—D. J. SPIRES, 141 Stone Ave., Tucson, Ariz. This invention has reference generally to beds, the object being to provide a folding and reversible bed frame which is particularly adapted to be permanently mounted between two rooms, for



FOLDING AND REVERSIBLE BED.

instance, an inside sleeping room, in such manner that it may be readily and quickly folded to assume an operative position within either room, and also movable to an upright or folded position within either room in which it may be in use.

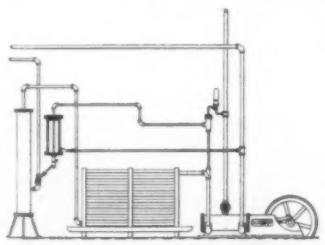
Machines and Mechanical Devices.

SAW TENSIONING AND STRAIGHTENING MACHINE.—T. W. ROACH, Lyman, Wash. This improved machine is especially designed for operating on circular saws although not limited in all its features for use with circular saws. The machine is serviceable also for use in straightening a concaved saw that has been forced over the saw collar.

VALVE.—M. J. WALSH, 124 E. Pine St., Mahanoy City, Pa. This inventor provides a blow-off valve so constructed that the main valve and its valve seat may be moved to a position outside of the casing, whereby it may be ground or otherwise repaired, and provides an auxiliary valve and valve seat which closes the valve and prevents leakage to the atmosphere at and during the time the main valve and its valve seat are exposed for repairs.

SPRING HAMMER.—J. H. PHILLIPS, care of Dougherty, Smith, Phillips Co., Oklahoma, Okla. This invention more particularly relates to a mechanically-actuated hammer. It is an improvement over the hammer in Mr. Phillips co-pending application serial No. 533,867. An object of the present invention is to provide a hammer which is automatic in its action and which will receive its direct force from a compressible spring.

SAFETY ATTACHMENT FOR COMPRESSION REFRIGERATING APPARATUS.—F. A. SCHNEIDER, 295 E. 162nd St., Bronx, N. Y. This invention relates to refrigerating and ice making systems, and its object is to provide a safety attachment for compression refrigerating apparatus arranged to automatically shut off the ammonia to the expansion coils, and to sound an alarm in case the pressure in



SAFETY ATTACHMENT FOR REFRIGERATING APPARATUS.

the systems exceeds the normal pressure. In order to accomplish the desired result use is made of means for closing a valve controlling the ammonia to the expansion coils, and for sounding an alarm.

Railways and Their Accessories.

AUTOMATIC CAR OILER.—J. T. MCREYNOLDS, Lilly, Ill. The object of the invention is to provide an inexpensive automatic car oiler, simple in construction and efficient in action, inclosed in a car journal box, and the efficiency of which is independent of the direction of rotation of the axle.

OPERATING DEVICE FOR STATION INDICATORS.—W. B. HILL, Hotel Seneca, San Francisco, Cal. The object here is to provide a simple and efficient operating device, especially adapted for use with the type of indicator shown and described in Mr. Hill's copending application No. 566,345. The device is operated by fluid under pressure, and the display mechanism may be operated by trips preferably arranged on the trolley wire at places where announcements are to be made, or by mechanism driven by movement of the car, which mechanism will actuate the displaying device at the proper intervals.

RAILWAY CONSTRUCTION.—G. SYMES, care of Coughton & Breese, Mason City, Iowa. The invention is an improvement in the class of railways in which the running rails rest on arched metal chairs or supports that are in turn secured to transverse metal ties. The invention is embodied in the construction and connection of the chairs or rail supports and the transverse ties connecting them.

NUT OR LOCKING DEVICE FOR SCREWS.—G. LAKHOVSKY, 5 Avenue du Bois de Boulogne, Paris, France. This inventor provides a nut or locking device for securing screws and particularly for the screw spikes in railway sleepers. The device offers great resistance to the tearing out of the screw spikes even when the sleepers are made of soft wood.

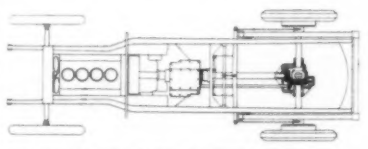
FLANGE OILER.—C. F. HOOFER, 345 Chemical Block, Spokane, Wash. This invention refers to improvements in devices for lubricating flanges of locomotives and other track vehicles. An object is to provide means whereby the flanges of locomotives or other vehicles may be oiled automatically at certain places where such lubrication is most necessary, such as on curves in the track.

Pertaining to Recreation.

GAME.—F. C. CREW, 4459 Evanston Ave., Apartment N, Chicago, Ill. The intention here is to provide an improvement in games, in which is provided a board representing a baseball field, and a series of figures representing the players, and wherein the figures may be manipulated on the board to imitate the movements of actual players in the game of ball.

Pertaining to Vehicles.

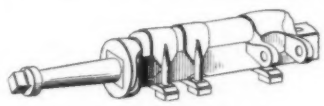
AUTOMATIC BRAKING DEVICE FOR AUTOMOBILES.—J. E. FISHER, JR., 34 W. 76th St., New York, N. Y. This invention relates to braking mechanism for automobiles and motor vehicles in general, and it is designed to be automatically thrown into action



AUTOMATIC BRAKING DEVICE FOR AUTOMOBILES.

to prevent racing of the driving wheels of the machine, when, owing to the nature of the road, or from any other cause, frictional engagement of one of the driving wheels with the ground is lessened. The engraving shows a top view of an automobile having the braking device in position thereon.

VEHICLE AXLE.—J. E. HEDGES, Winterpock, Va. This invention is an improvement in that class of vehicles having detachable



VEHICLE AXLE.

journals or spindles, and particularly in that class in which the axle ends are slotted and the journals or spindles provided with shanks adapted to fit in such slots. The chief objects of the improvement are to avoid weakening the axle by the construction required to effect such engagement.

Designs.

DESIGN FOR A HAMMER.—H. B. WILSON and H. O. GEPHART, care of Van Doren Mfg. Co., Chicago Heights, Ill. This ornamental design for a hammer represents an implement of excellent proportions, and the effect of the angles in this design contributes to producing a hammer of very fine lines. The same designers have patented another design of a hammer which corresponds with the first, except that the end of the tool is perfectly plain.

NOTE.—Copies of any of these patents will be furnished by the SCIENTIFIC AMERICAN for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

The Industrial Need of Technically Trained Men—I.

Scientific Manufacturing and the Opportunities It Offers

By Waldemar Kaempffert, Managing Editor of the Scientific American

[IT is the intention of the SCIENTIFIC AMERICAN *to publish a series of monthly articles on the professional opportunities that await the technically trained engineer, physicist, chemist, bacteriologist and technologist in modern life. Last year, it will be remembered, a series of articles was published written for the most part by well-known educators connected with our leading technological institutions. They showed how institutes of technology were endeavoring to meet the requirements of great manufacturing railway and municipal corporations. This year's series, written by the heads of great corporations—companies which are capitalized at millions of dollars, which employ thousands of men, and which are scientifically organized and managed—will show how great is the need of trained chemists and engineers. As an introduction to the series we publish the following review by our Managing Editor, the purpose of which is to give a glimpse, as it were, of the rich prizes that can be won by the trained technologist.*—EDITOR.]

The modern manufacturing corporation, which requires acres of floor space to carry out its processes, which each day converts whole train loads of wheat, leather or iron ore into flour, shoes, or steel rails, needs brains more than brawn. So vast are its operations that it pays to save a few cents in the production of a ton of pig iron, to devise a steam shovel which will scoop up five tons of ore at a time with a slightly less consumption of energy than was possible before, to analyze chemically the wastes of manufacture and to devise means of utilizing them. No manufacturer can afford to ignore the technologist. Competition is no longer consigned to the selling market. There is a rivalry in improving manufacturing methods as well as in merchandising. Millions are annually spent by business men on scientific and engineering investigations that would have been regarded as purely academic twenty years ago, but the ultimate commercial value of which is immediately apparent to the broad-minded merchant of to-day. Even the manufacturer who employs only a dozen men must engage in this intellectual rivalry. He cannot always afford to engage permanently a laboratory expert, but he must at least obtain the advice of a consulting chemist or engineer if he is not to be utterly crushed.

Despite its utilitarian and commercial character much of the scientific investigation undertaken by the great modern manufacturing corporation has a fascination all its own. Indeed, the results achieved often affect not simply one particular industry, but a whole science. In the city of Cleveland, for example, one of our great electrical companies maintains a number of laboratories, the sole purpose of which is to improve our methods of illumination, and to give us a light which is more efficient than anything now produced. The studies there conducted involve chemical and physical research of a high order, physiological and psychological studies of the effect of various illuminants on the human eye, engineering researches that will measurably bring us nearer to the "cold light," of which illuminating engineers have lately written so much. In a word, the entire subject of light is studied with a thoroughness never before attempted, and with a total disregard of money. Who can doubt that research thus conducted will not simply enrich the world with illuminants better and cheaper than anything we have now, but that the whole science of optics will assume a new importance?

Because of the huge capital which it commands, the modern manufacturing company can experiment on a stupendous scale to realize an idea correct in theory. The development of the Curtis steam turbine, for example, involved the expenditure of millions. That vast sum was not spent in empirical experimenting, but in practically testing the thermo-dynamic views of engineers whose one task in life was the perfection of the steam turbine. Work such as this is comparable with the finest research conducted in any university. What is more, it is richly paid for; for your great manufacturing corporation, unlike your great university, is not niggardly in rewarding the trained men to whom the development of its processes is due.

It has been supposed that the all-devouring trust crushes its weaker rival by the sheer weight of its money. The truth is that trained minds easily triumph over mere money. In twenty-six public hearings, recently held in Washington by the House Committee on Patents, to consider the views of inventors and manufacturers on the advisability of introducing compulsory licenses into our patent system, it was abundantly demonstrated that the trained technologist is more than a match for the trained capitalist. The patent counsel for the greatest sewing machine manufacturing company in this country testified that, were it not for the experimental laboratories conducted by three or four smaller sewing machine manufacturers, the company that he represented would undoubtedly monopolize the market. In other words, a handful of highly paid and splendidly trained technical men were able by sheer ingenuity to cope with the dominating company.

Before the same Congressional committee Mr. Spencer B. Miller, a well known engineer, drew a vivid picture of the manner in which a modern manufacturing company utilizes trained engineers. Mr. Miller has made a life study of conveying machinery. To him we owe the system of coaling battleships at sea, which has been adopted by the United States Navy. He revealed the manner in which his company had deliberately studied market conditions and devised machinery to meet special needs. Cypress logs, for example, had long been hauled out of Louisiana swamps at an enormous cost. Mr. Miller was engaged to devise the best mechanical system possible for taking out the logs. He did so with such success that not only were cypress logs eventually sold far below their old price, but that swamp land, which had once brought only $1 an acre, commanded $75 per acre. Experts like Mr. Miller, trained in technological schools, are needed more and more. The American telephone system, a marvel of efficiency, is the creation of a dozen engineers whose work is confined entirely to the improvement of telephonic communication. They are engaged at princely salaries to meet the needs not only of to-morrow, but of the day after to-morrow, to devise systems for which there is no immediate use, but which will become of paramount importance when a city of two million inhabitants has increased in population by one hundred per cent.

Those who have read the addresses of the recipients of the Perkin medal, awarded for distinguished achievements in chemical engineering, must have been struck with the opportunities that await the trained man in that one field alone. Herman Frasch told how the application of chemical principles enabled him to rid Canadian oils of their sulphur, and thus to make them more generally salable, how he had improved the methods of salt-mining, and above all, how he had successfully solved the problem of raising to the surface the sulphur buried beneath Louisiana quicksands, after a dozen men before him had failed. So, too, James W. Gayley, an academically trained metallurgist and a former vice-president of the United States Steel Corporation, showed how, with his dry blast process, he had markedly improved our methods of reducing iron ore.

At the International Congresses of Hygiene, Chemistry and Testing Materials, held last year in this country, paper after paper was delivered bearing ample testi-

mony to the achievements of trained men in modern industry, and therefore indirectly proved the opportunities that awaited the technical graduate. Thus, in discussing the production of synthetic rubber by Harries and Hofmann, Prof. Duisberg showed how all the resources, both technical and financial, of a great German chemical company are being used in endeavoring to produce rubber by artificial means so cheaply that the chemical factory can some day compete with the plantation—a work on which dozens of trained chemists have been unremittingly engaged for years. Prof. Bernthsen showed how important has been the aid of the trained chemists employed by the company of which he is the head, in reducing nitrogen from the air, so that the exhaustion of the Chilean nitrate beds, so frequently prophesied, is no longer a cause for alarm. Nearly every one of the papers read before the societies mentioned was prepared by men who are employed by European and American manufacturing companies. They revealed how refined are the scientific methods which are now necessary in carrying out manufacturing processes on a large scale, how hopeless it would be to attain the same result with the aid of men who have not had the benefit of listening to a great teacher in a great technical institution and how increasingly necessary is the employment of the technical graduate in modern industry.

Recent Improvements in the Storage Battery

(Concluded from page 247.)

cell consists of electrodes of spongy iron and nickel hydroxide in a caustic soda solution. The caustic soda serves merely as a carrier of ionic oxygen and hydrogen and does not become exhausted, so that impoverishment of the electrolyte is not a serious difficulty, as in the lead cell.

In order to increase the conductivity of the active masses, Edison impregnates both the iron and the nickel electrodes with a bismuth compound. The bismuth reduces to the metallic state in the iron electrode upon charging, thus forming conducting veins throughout the mass. Estelle, in Sweden, prefers to add cadmium. Achenbach uses boron. Others have shown the application of the Planté process of electro-chemical formation to these electrodes.

Zinc Lead-dioxide Cell: The substitution of zinc for the spongy lead plate commends itself because of the material increase in voltage. A difficulty lies, however, in the fact that zinc dissolves during discharge, and in being electroplated out upon charge, it tends to deposit in a porous, loosely adherent mass, and so become dislodged from its support. This condition necessitates the use of horizontal electrodes, the zinc preferably being in the bottom of the cell. Numerous modifications of this type are found, in which zinc is combined with various elements.

Morrison shows a number of screens of woven copper wire *A* (Fig. 1), these screens being silver or copper plated and amalgamated by dipping with mercury. Zinc is electroplated upon this support during charge. The upper electrode *B*, separated from the lower one by an insulating plate *E*, may be made of aluminium, copper, silver or nickel. Morrison so proportions the relative quantities of the zinc and the caustic soda electrolyte that only a part of the zinc dissolves, the rest remaining on the support and merely oxidizing. Morrison also has found that the zinc is held insoluble by the addition of cadmium.

Other Battery Combinations: Perry has a positive pole electrode of nickel and silver oxides, an electrolyte of potassium zincate and a negative pole plate of zinc. A combination of zinc, chromium and mercury for the negative pole plate and mercury and silver oxides for the positive is used by Morrison. He prefers an electrolyte of caustic potash containing chromium hydroxide or a chromite.

Regeneration: The lead sulphate formed in the normal discharge of the lead cell

This Ad. Deals with the Subject of Shortage of Sixes for 1913

FOR, OF COURSE, THERE'S GOING TO BE a shortage of Sixes. Nothing could be more certain—nothing is giving the trade more concern at this moment. Dealers are worried and prospective buyers are beginning to be.

THIS AD. WAS PUBLISHED March 2nd in all principal newspapers in the United States. Thirteen days from then is March 15th—then comes the deluge.

"'WARE THE IDES OF MARCH!" we say in the automobile business, for we have learned to regard the Roman Soothsayer's warning, though it was not originally intended for us.

SEEMS AS IF EVERYBODY in the world wants his automobile delivered in the six weeks between March 15th and May 1st. That's a condition that is at the same time welcomed and dreaded by makers whose product, as ours, enjoys a ready demand.

WE WELCOME IT BECAUSE it means big business—and we dread it because we know it also means disappointment to many good customers—bitter disappointment to some.

IT ALWAYS HAS BEEN SO—it probably will continue to be so. Tardy buyers are bound to be disappointed. Yet among the tardy buyers are many good friends who have always depended upon this organization to furnish them automobiles of more advanced design, of a better quality and at a lower price than could be had elsewhere.

TARDY BUYERS ARE NOT TO BLAME for being tardy. Mostly they are too busy with other matters, or are unfamiliar with things automobile. Anyway, they are liable to believe there will be plenty of cars to go around.

PERHAPS THERE WILL BE—BUT there never has been, and those best competent to judge know that the shortage of the kind of cars you want will be greater this year than ever before.

GET THAT! THERE MAY BE plenty of cars. But there won't be plenty of Sixes, and there will be still less of the kind of Sixes that will measure up to the standard of the man who knows—and we are assuming that you are one of these.

WE ARE NOT INTERESTED so much in the man who doesn't know. We are not making cars to meet that demand.

BUT WE ARE VITALLY INTERESTED in those who do know. They are the readiest buyers of cars that do measure up to their standards—and the best customers afterward.

THAT'S WHY WE ARE PUBLISHING THIS AD.—to warn those who know and who are going to insist on having a Six, that there is not only going to be a shortage of Sixes generally, but a discouraging shortage of Sixes of that kind.

LET US REPEAT—This ad. is only for those who know what does and what does not constitute a successful Six. Those, in short, who know what they want—want what they want—and who will not accept a substitute. And we repeat we are assuming you are one of these.

NOW LET'S GET DOWN to brass tacks.

FIRST LET US SEE WHY there is a shortage of Sixes. Reason is simple—greater demand than possible supply. Why? Because buyers came to realize the superiority of Sixes sooner than most makers.

OR, TO PUT IT ANOTHER WAY: Buyers learned the advantages of Sixes sooner than most makers thought they would. Makers knew all the time, but didn't think the average buyers was aware of it.

WE PLEAD GUILTY to having precipitated the trouble. And here's how it happened: In our advertisement announcing the sensational Maxwell "50-6" (then the Flanders "50-6") we said, "If You Are Paying More Than $1,200 for a Car, You Are Entitled to a Six."

AND WE TOLD YOU WHY. And you and all the rest of the automobile buying world understood—evidently; for a landslide followed immediately after. Buyers began to demand and to insist on Sixes in all cars from $1,200 upward. And as always happens, dealers echoed the demand of buyers.

NOW, YOU'LL RECALL WE DIDN'T say we had a Six at $1,200; but we did announce the five-passenger Maxwell "40-6" at $1,550 at the same time we announced the seven-passenger Maxwell "50-6" at $2,350. And we predicted that the man who knew would decide he would rather pay the difference and have a Six than have an obsolete "Four" at the lower price.

WELL, EVENTS PROVED that we were right. And it didn't take long either. In fact, it happened in a remarkably short space of time. Most makers were caught unawares. That's why we have termed it "an avalanche."

INCIDENTALLY, WE SUDDENLY BECAME very much disliked in the trade. We had committed the unpardonable sin of telling the buyer something that other makers protested was "none of his business." However, we will probably survive that. We're used to it.

WHAT WE ARE UP AGAINST—and the only thing that really matters to you or to us—is the fact that there aren't enough Sixes to go around. We know it. Everyone in the trade knows it. And we are telling you.

AND WHILE WE ARE TELLIN', LISTEN—for here's something perhaps you didn't know.

THE IMMEDIATE RESULT of our sensational announcement—aside from the impression it made on prospective buyers—was to upset all carefully made plans of competitors. There were conferences, meetings of the "Ways and Means Committees," and anxious discussions between directors and engineers. The problem was, how to meet the new conditions—how to meet the insistent demand for Sixes.

FOR YOU MUST KNOW that while all makers foresaw the conquest of Sixes in all cars of 40 horse-power or over, most of them agreed that, except in cars of the highest price (say, $4,000 and over), buyers would be willing to accept "Fours" for yet another season. There's where they miscalculated, and the matter had suddenly assumed a very serious aspect.

THE PROBLEM THAT CONFRONTED THEM was how to produce Sixes to meet the insistent demand. And most of them went about it by the shortest and most obvious route.

NOW GET THIS—IT'S VITAL. Demand always creates supply. The Six demand was no exception. It resulted in a supply of Sixes—but not the kind of Sixes you want if you know the difference between what constitutes a successful Six and the other kind. And we are assuming you do.

MANY CARS ARE OFFERED under the name of Sixes—but most of them are only converted Fours.

"WHAT IS A CONVERTED FOUR?" you ask. And we are glad you ask, because we know the answer. A "converted Four" is a Six that has been hurriedly produced to meet an unforeseen demand by the simple process of adding two to the Four the maker already had.

THAT'S SIMPLE, ISN'T IT? It's the obvious—in fact, the obviously obvious way to do it.

BUT "IT SIMPLY CAN'T BE DID." You can produce a "Six," but not a successful Six that way. There are engineering problems in a Six that do not arise in the designing or making of a Four. Space does not permit us to enter into this important matter in detail here, much as we should like to do so. For it is important—vitally important to the buyer.

WE HAVE, HOWEVER, TREATED THIS matter exhaustively in a little booklet, which we will be glad to send you, the title of which is "Two Added to Four Do Not Make a Six."

IF YOU WANT TO KNOW about Sixes so as to be able to choose intelligently, you'll find more real information in this booklet than you'll get elsewhere. And it's authentic. Without being too highly technical, its contents emanated from the engineer who knows, perhaps, a little more about designing Sixes than any other in this industry. He's the man who designed the Maxwell "50-6."

BETWEEN THE LINES we tell you wherein and why the Maxwell "50-6" is superior. But you are just as much interested in learning that as we are in telling you. Its perusal will be worth while—you'll be able to tell the average salesman more than he knows about Sixes, and once you've digested its contents you will be able to tell, by simply lifting the hood, which is a "converted Four" and which is a true Six—designed from the ground up as a Six.

MEANTIME, YOUR CHIEF CONCERN is how to get your Six, despite the shortage of Sixes generally, and especially of the type of Sixes you want—Sixes that have been designed by makers who believe in Sixes and who know how. That's your only concern.

ANSWER is, GET IN LINE QUICKLY—see your local dealer and place your order, specifying delivery when you will want the car—and you will get it while others will be waiting and cussing as in years past because makers cannot make enough of the kind of cars that are in most demand.

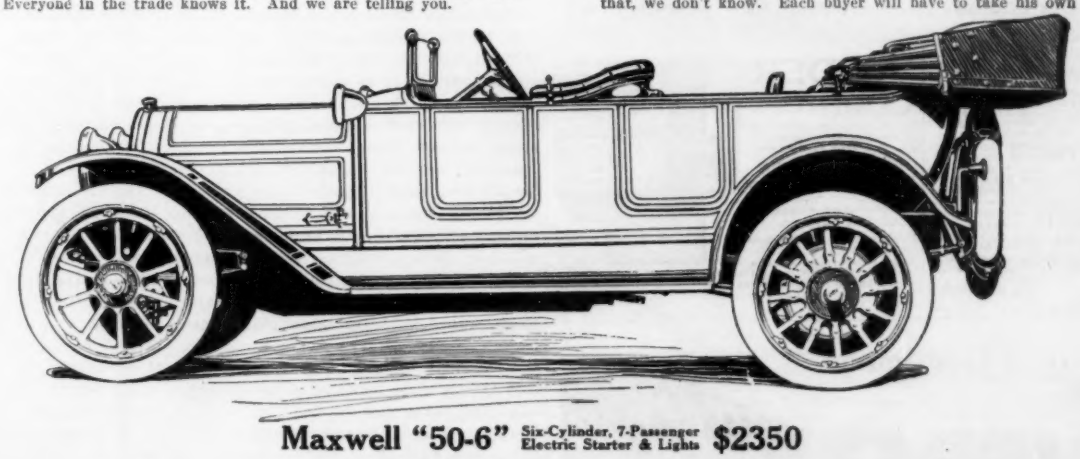
YOU'VE NOTICED, DOUBTLESS, that we have said little in this Ad. about our own particular product—Maxwell Sixes. Reason is we don't need to. When by a process of elimination, you have excluded from your consideration the converted Fours and other Sixes that do not come up to your standard, there will be few left to select from—and foremost and most desirable among these few will be the Maxwell "50-6."

THE MAXWELL "50-6" is a car of such power, such beauty, such capacity and of such quality throughout, as you had expected to pay at least $4,000 for—and we contend it cannot be equalled even at that price.

BODY DESIGNED BY BRUCE OTT and already being copied by other makers. Motor designed by William Kelly, one of the earliest advocates of the Sixes and an engineer who is recognized by his contemporaries as one of the foremost, if not, indeed, the foremost authority on six-cylinder cars.

OUR PRICE ($2,350) is made possible only by our superior manufacturing facilities, and the fact that we are the largest makers of Sixes.

IF YOU HAVEN'T SEEN and ridden in this magnificent car, you owe it to yourself to do so at once. There isn't a day to lose. Orders placed within the next ten days will be sure of delivery almost on the day specified. After that, we don't know. Each buyer will have to take his own chance.



Maxwell "50-6" Six-Cylinder, 7-Passenger Electric Starter & Lights **$2350**

MAXWELL MOTOR COMPANY

DETROIT, MICHIGAN

New York, N. Y., Boston, Mass., Philadelphia, Pa., Chicago, Ill., St. Louis, Mo., Minneapolis, Minn., Detroit, Mich., Kansas City, Mo., Dallas, Texas, Pittsburgh, Pa., Omaha, Nebr., Des Moines, Ia., Atlanta, Ga., Charlotte, N. C., Indianapolis, Ind., Denver, Colo., San Francisco, Cal., Los Angeles, Cal., Portland, Ore., Memphis, Tenn.

WARNING:—Dealers with good intent sometimes oversell their allotment, hoping by extra pressure on the factory to get a few more cars of the popular types. In the case of Maxwell sixes for 1913 this is dangerous. We have allotted to dealers (and there are over 1,000 Maxwell dealers) every Six we can hope to make, even with our tremendous facilities. Buyers will do well, therefore, to insist on knowing how many sixes the local dealer has been allotted, and how many he has sold. Also, we are informed some dealers are claiming to represent the new Maxwell line who have not been authorized. If in doubt, write us and we'll tell you frankly. Then place your order, pay a cash deposit to bind the sale, get a definite delivery date—and you are secure. Your car will be delivered within ten days of the date specified, if not on the exact date. But get the order in at once.

should remain scattered throughout the plate in a finely divided condition, so that upon charging, it may be readily transformed to the oxide or the spongy lead. When the sulphate collects in large white patches, which are non-conducting, and so remain unchanged during the battery action, the cell is said to be sulphated. A regeneration of such sulphated batteries is accomplished by Luckow, Friedrich and others in the following general manner: The cells are emptied, washed out and filled with water. The acid clinging to the plates furnishes sufficient conductivity. A current is passed through the plates in a direction opposite to that of charging for 4 to 8 days, with a current density of 20 to 50 amperes per square decimeter, until the plates are completely reversed, the oxide to spongy lead and *vice versa*. The current is then passed in the opposite direction for 3 to 6 days more, and finally the plates are charged in the regular acid bath. The electrolyte for this regeneration may be a one per cent solution of potassium or sodium sulphate, carbonate, borate or hydroxide. The last three compounds serve to neutralize the sulphuric acid set free during the process, thus keeping down the apparently objectionable acidity.

Preserving the Electrodes: It is known that lead, zinc and iron electrodes tend to oxidize on drying. This brings a mechanical difficulty into the shipment or care during long continued disuse of such plates. A German patent to Heym states that if the negative pole plate is washed and then dried in a vacuum or in gases that do not attack the metal, it does not oxidize upon being brought into the air.

Separators: The ordinary perforated plates of rubber or celluloid often allow the lead to "grow" through the perforations and bridge the electrical gap. It, therefore, has been found necessary, in many instances, to use a porous diaphragm, also. Wood is found to be most suitable, but certain impurities, such as acetic acid, resins, vasculose, etc., which are injurious to the lead active materials, must be removed. This may be done by treatment with an ammoniacal solution of copper oxide, by oxidation by means of hydrogen peroxide, nitric acid, hypochlorites, etc., or by solution in alkali and alcohol. Marino treats with steam under pressure and then with hydrogen peroxide. Dodge soaks the wood successively in sulphuric acid and potassium hydrate. DeMartis treats a woven fabric in a similar manner, so as to have left only the pure cellulose.

Circulating Electrolyte: Because of the well known limitations of the regulation storage battery, two other theories are being made the basis of experiments: that of circulating the electrolyte around or through the electrode and that of generating current from various exothermic chemical reactions, using inert electrodes. By the first method, the reaction products are forced from the pores of the electrode, either continuously or intermittently. For example, Hite circulates the electrolyte along the face of the plate and through the mass of a suitable depolarizing oxide, made porous by being mixed with asbestos or cement. Benko forces an electrolyte carrying oxygen or chlorine in solution through the pores of a carbon cathode, zinc being the anode. In the lead storage cell, Sokal pumps the acid through the porous walls of concentric cups, which are filled with the lead active materials.

In the other type of cell, which generally would involve the circulation of electrolyte also, a liquid or gas capable of being oxidized reacts through a porous diaphragm with another similar substance capable of being reduced. The energy ordinarily given us as heat in such chemical reactions is thus obtained as electrical energy. Thermo-chemical formulæ will show what E.M.F. can be expected from a given reaction, thus foretelling its practicability. Basset describes an example of this cell, wherein the energy is obtained from the reaction of bromine or nitrous acid upon sulphurous acid in sulphuric acid, both electrodes being carbon. The reaction using bromine, which gives about 0.6 volt, is one of oxidizing SO_2 to H_2SO_4 and reducing Br to HBr.

The structure used by Basset is shown diagrammatically in Fig. 2. Carbon plates *1*, *5*, *9*, *13* are held between insulating frames *2*, *4*, *6*, *8*, *10*, and *12* of celluloid and separated by porous diaphragms *3*, 7, and *11*. The path of one liquid is indicated by the arrows, the entrance being at *H* and the exit at *K*. The other liquid circulates similarly in the other compartments.

There is a wide open field for those working on these last mentioned theories, especially in the use of organic compounds, many of which have high calorific values, such for example as the explosives. As a result of this future progress, we will soon run our cars by electrical power furnished from two tanks or packages containing, as it were, concentrated energy which can be set free in a battery. Even to-day we have a forerunner of this in the use of steel tanks of liquid chlorine or compressed hydrogen and oxygen in the gas battery.

Machines for Printing Railroad Tickets

(Concluded from page 249.)

gear which meshes with a bevel gear on a main vertical shaft. On this vertical shaft is secured a circular table. Near the edge of the table is a second vertical shaft intermittently driven which operates mechanism for feeding forward a strip of paper and printing thereon the main body of the ticket. The strip of paper then passes over an aperture in the table. A cutting device then descends and cuts off the part required for the ticket, and at the same time the date is stamped on the back. The table is now rotated to bring the ticket under the printing wheel mounted on the top of the machine. This wheel is composed of disks *A* and segments *B* carrying on their peripheries name plates of the various stations on the railway system. The main wheel, as well as each disk, is rotatable, which makes it possible to arrange a very large number of type plates in a small compass. The name plate of the station desired is brought immediately over the table, and when by rotation the ticket arrives under the type plate, a plunger rises and presses the ticket against such plate. As the table moves on, a numbering device stamps a serial number on the ticket. For inking the name plate and the numbering plate, an inking ribbon in the form of an endless belt is used between the ticket and such plates. A strip of paper for auditing purposes, carried by unwinding and winding rolls, passes transversely between the folds of the inking ribbon, so that the place of destination and number is printed on such strip for each ticket printed.

In the machines just described, provision is made for numbering all the tickets with one serial number, but in the next machine (Fig. 3) the tickets to each station have their own serial number. In this machine, there is a horizontal axle carrying at the front of the machine a disk *D* having the names of various stations marked thereon, and inside the casing a similar disk carrying on its periphery type plates for printing the names of such stations and occupying the same relative positions as the names on the front disk. At one end of each type plate are mounted numbering disks which are operated each time such type plate is brought into use so as to number consecutively the tickets sold to such station. On the other side of the disk bearing the type plates are located small numeral disks which are operated each time a ticket is printed for the purpose of registering the total number of tickets sold. In order to make up a report of sales, the inventor has provided a web of paper mounted on suitable rolls, and at any time these rolls may be thrown into operation so that the web is impressed against each type plate and its serial number in turn. By this means the agent may learn the number of tickets sold for each station.

The last considerable improvement in these ticket printing machines was the addition of the cash register-feature. Such a machine is shown in Fig. 4. In this machine the date is first printed on the back of the paper strip, and this strip then passes between an impressing roll *1* and a printing cylinder *2*. On the periphery of this cylinder are fixed type for printing the general reading matter, such as the name of the railroad, station where sold, conditions of sale, etc., and also a groove for holding the type bar for printing the destination. These type bars are normally carried by spring pins on two endless bands *3* mounted on two drums *4*. Mounted alongside the type bar carrier are two sprocket belts *5*, one of which passes around a fixed sprocket wheel on the axle of one of the drums, and the other over an idler on such axle. To the first belt is secured a carriage which slides on a rod mounted parallel to such belts. At the front of the machine are arranged several banks of keys similar to a cash register, there being one key for each station, and such keys being arranged in the same sequence as the type bars on the carrier. When one of these keys is depressed, the carriage is made to clamp the second or power driven sprocket belt at the proper place so as to bring the proper type bar opposite the slot in the printing cylinder. At this point the carrier stops and a device grips the type bar and inserts it in the cylinder, which then rotates to print the ticket. When the cylinder has completed its rotation the type bar is removed to the carrier and the carrier is then made to assume its original position.

The end of each type bar is notched in accordance with the price of the ticket to the station and mutilated racks or slides are made to move up against this notched end every time the type bar is used. These racks or slides set in motion the mechanism for use in recording the amount of sales. Underneath the registering mechanism, the auditing sheet is made to travel, and each time the printing cylinder revolves, the total of sales is printed on the sheet, and a hole is also punched in the sheet opposite the station to which the ticket is sold.

This machine is operated by a weight motor *6*, and when the weight is wound up and the desired key has been depressed, motion is transmitted intermittently to the various parts of the machine for performing the following operations: the proper type bar is brought opposite the slot in the printing cylinder and transferred thereto, the printing cylinder revolves once, printing the ticket on the upwardly moving strip, the type bar is returned to the carrier and the carrier moves back until the type bars are in their proper positions. While this movement is taking place, the registering disks are advanced in accordance with the price of the ticket and the total amount is printed on the auditing strip. Likewise, the auditing strip is punched in the proper place and the printed ticket is cut off.

A new railroad ticket printing machine which is expected to facilitate the sale of tickets has been introduced on the Prussian Government Railroad. The machine prints tickets to all stations, and the ticket seller has nothing to do but to put a blank ticket form into a slot and to set the machine by means of pushing a carriage so that it will print a ticket as he wishes. The apparatus prints the ticket, also a control slip which shows all the tickets that have been printed and sold. The control over the business the ticket seller has been doing is thereby complete. The printing of the tickets takes less time than the hunting for the ready made tickets in the different pigeon holes, for the ticket seller has nothing to do but to take a piece of cardboard from a heap at his side, to insert it into the slot and to move two levers.

From the foregoing, it will be seen that much thought and study has been devoted to the development of this class of machines, and while the latest types are decidedly complex, they are not unduly so considering the results accomplished. The

inherent difficulties are no greater than those met with in the cash register now of such general use, and there appears to be no good reason why these ticket machines, when once perfected, should not come into general use.

A New Gear Engine

(*Concluded from page 245.*)

"The advantage of this cycle lies not so much in the cycle itself as in the form of the machine which the cycle permits to operate on it. The engine possesses the same advantages as the turbine over the reciprocating engine in that all of the parts in contact with the steam are at a constant temperature for any constant load condition, and the heat losses due to cylinder condensation in the reciprocating engine are obviated. The engine operates at much higher speeds than piston engines and, therefore, allows the use of smaller and consequently cheaper constructed machinery, such as electric generators, centrifugal pumps, etc. As it uses the pressure energy of the steam instead of the kinetic energy it does not have to meet the difficulties encountered by the steam turbine in dealing with enormous steam velocities which have given no very great trouble with large size turbines, but have rendered small turbines uneconomical."

The novelty of this new system of compounding, when considered in conjunction with the good water rate already obtained by the single-stage unit, furnishes very interesting computations relating to its future possibilities. Mr. Charles H. Clark, the inventor of this gear engine, is not the first to devise a gear engine. Many attempts have been made to produce a practical engine of this type in the past. The most important differences between the Clark engine and other gear engines resides in the fact that the gears *A* are inclosed at their meshing point by a stationary structure (with sufficient clearance to allow the gear to revolve freely) to direct the fluid against the teeth, but elsewhere they are not inclosed at all, except, of course, by the casing *B*, which leaves plenty of space for unimpeded movement or expansion of the fluid. Heretofore the inclosure employed has always been either so close to the gear, not only at their meshing points, but elsewhere also, that a powerful suction is produced which opposes the rotation of the gear, and hence cuts down the efficiency of the engine; or else the structure inclosing the gears at their meshing points has been so mounted that it can be moved by the driving fluid, the idea being that it will in this way be self-adjusting. But this does not work in practice, for it permits wasteful leakage and binding of the parts which should move freely with the least possible friction.

Quite as interesting as Mr. Clark's engine are the accessory mechanisms introduced by the inventor to adapt his engine to practical working conditions. The drawing, Fig. 2, shows a novel speed gear by which the speed of the engines may be reduced 20 to 1. The power shaft *G* is formed with teeth cut therein, adapted to be engaged by the teeth of six spur wheels *H*. The spur wheels are arranged in two sets of three, with their shafts arranged in a circle about the shaft *G*, and disposed sixty degrees apart. These shafts in turn bear pinions which engage a single spur gear mounted on the driven shaft. As the power shaft *G* is surrounded on all sides by spur gears, practically all of its teeth are in engagement at all times, and there is no thrust to contend with. As each tooth of the power shaft is doing its share of work, the teeth may be made much smaller than would otherwise be required. In the illustration, which is drawn to scale, the power shaft is but one inch in diameter. Yet through this small power shaft 40 horse-power has been delivered at a speed of 3,500 revolutions per minute and stepped down to 180 revolutions per minute at the driven shaft.

The power shaft is connected to the engine shaft with a flexible coupling. The

coupling consists of short spring rods arranged in a circle, something like a lantern gear. This flexible coupling permits the power shaft *G* to find its own axis of rotation. In fact, the power shaft has practically no bearing other than that afforded by its engagement with the spur wheels *H*. The tooth speeds afforded by this system of gearing are one sixth of that now employed in speed reduction gears, and about twice as much work is done, the factor of safety being about twice as great at low speed. The gears do not travel over twenty feet per minute.

Another interesting development in connection with this engine is a governor invented by Mr. Clark. The governor can be adjusted so that the speed will either increase or decrease as the load is increased, and there is a point of intermediate adjustment which gives constant speed under all conditions. The details of this governor are shown in Fig. 3. The balls of the governor are in the form of two sectors *J*, which engage a rack *K*, connected by suitable means to the throttle. The speed of the governor varies as the radius of the circular path of the ball or weight about the axis of gyration of the governor and as the sine of the angular displacement of the center of gravity of the ball from the plane passing through the pivot of the ball perpendicularly to the axle. As both of these quantities are variable. Mr. Clark has so designed his governor that the variation will be equal through a considerable arc of travel of the weight. This he has succeeded in doing by placing the center of gravity of the weight *J* in such a position that at any given speed the torque or tendency of the weight to swing out varies directly as the displacement of the centers of gravity of the weight from the theoretical neutral position. In the Clark governor the fulcrum of the governor ball is 2.5 times farther from the axis of gyration than the distance of the center of gravity from the fulcrum.

Bee Insurance in Switzerland

THE latest of the diversified forms of insurance applicable to rural life and industries is the insurance of bees against foul brood, now in successful operation in Switzerland. This dread disease, which is due to bacteria of extraordinary vitality, is extremely infectious. A hive in which it occurs is a source of danger to the whole neighborhood; since it is sure to be plundered by bees from other colonies, which carry the diseased honey and comb to their own hives. It is, therefore, a matter of great importance to the community that such hives should be promptly dealt with in the usual way; the combs removed and burned, new combs started and melted down after a few days, and the apiary completely disinfected.

In order to minimize the loss in such cases, the Swiss Beekeepers' Association decided a few years ago to establish a system of foul brood insurance, to be compulsory upon all the members, about 7,000 in number. The beekeepers pay a premium of 5 centimes (1 cent) a hive. In return for this they are guaranteed free treatment of infected or suspected hives, instruction and assistance in disinfecting, and compensation to the extent of 75 per cent of the value of hives and comb destroyed by the inspectors. As a further means of protecting members, persons who are not policyholders are also aided, and were, until recently, indemnified for 50 per cent of their losses.

In December, 1909, the Swiss government decided to take over the duty of inspecting and treating diseased hives, and the association was thus relieved of much expense. Moreover, as all beekeepers are now obliged by law to sacrifice their hives when infected, the association has no longer a motive for indemnifying non-members, and has ceased to do so.

In 1911, the number of hives insured was 105,179; cases of foul brood, 114; and the expenses of the organization, including claims paid, exceeded the premiums by 342 francs—a trifling loss for a mutual insurance society.

History-Making Cars

By R. E. Olds, Designer

For 26 years, and in legions of cars, I have written a good bit of motor car history.

Reo the Fifth sums up all the results of it. It embodies all I've learned.

This is the latest of my history-making cars. And you who would know what time has taught will find it all in this 1913 chassis.

Go Deep

Go below the trappings of a car.

We don't minimize appearance, equipment, up-to-dateness. One glance will show how highly we regard them.

Here's a 17-coated body. Here is deep, rich upholstering, made of genuine leather. Here are electric lights, comfortable springs, nickel trimmings, set-in dash lights—comfort, luxury and room.

But those are easy and apparent features. Makers dare not skimp them. So you must go below these things to measure up a car.

Basic Worth

And a new car's performance is no criterion of value. Any modern car makes attractive demonstrations.

The real question is how that car will perform in five years from to-day. What will be the cost of up-keep and repairs? How will the car meet an overstrain? What troubles will it give me?

The answer to those things lies in the chassis. There is where you should look.

What You'll Find

In Reo the Fifth you'll find steel made to formula. Steel which we analyze twice before using to be utterly sure of its strength.

You'll find gears which were tested in a crushing machine of 50 tons' capacity.

You'll find 2-inch, seven-leaf springs, made from just the center one-third of the finest steel ingots. Springs which we test for 100,000 vibrations.

A $75.00 magneto—

A doubly-heated carburetor—

A costly centrifugal pump.

You'll find in all driving parts big margins of safety—not less than 50 per cent. For all of these parts are tested to sustain a 45 h. p. engine.

Costly Items

Those oversize tires—34 x 4—cost $60.00 more than tires which some regard sufficient. They are put on to double your tire mileage.

There are in this car 15 roller bearings, 11 of which are Timken. They cost five times as much as common ball bearings. Yet we might call this a Timken-bearing car if we used but two such bearings.

We use in this car 190 drop forgings, to avoid all risks of flaws. Steel castings cost one-half as much.

Each car must pass a thousand tests and inspections. Nothing is left to chance. Important parts are all fitted by hand—ground over and over to get utter exactness.

Each engine gets five long-continued tests, three of which are unusual. These tests require 48 hours. After certain tests we take each engine to pieces, and inspect every running part.

To insure every precaution with every car, we limit our output to 50 cars daily, so men are never rushed.

As a result, every Reo the Fifth goes out a perfect car. There are no defects, no shortcomings, to bother the man who gets it.

The Hard Things

These are the things which are difficult and costly. They add, I figure, $200.00 to the necessary cost of each car.

It took years and years for me to learn their importance. And it takes the user years sometimes to find out all they mean.

It is easy to add attractions which all buyers see. But these hidden things take courage.

But all the faith which men have in me rests on this hidden worth. Men have come to expect it, and they'll always get it in any car I build.

And the demand for this car—always twice our production—shows how men are turning to the well-built car.

One Rod Controls It

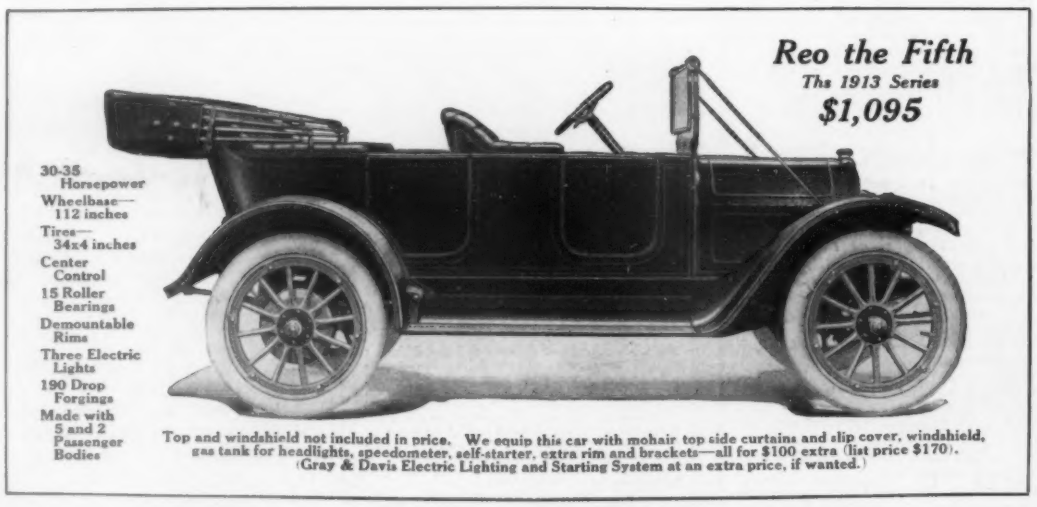
One small rod between the two front seats does all the gear-shifting in Reo the Fifth. The driver moves the rod only three inches in each of four directions.

He sits on the left side, as in all up-to-date cars, so this rod comes at his right.

There are no levers, side or center. Both brakes are operated by foot pedals. So the driver's entrance, on either side, is entirely unobstructed.

This form of control, exclusive with us, is one of this car's great attractions. It makes gear-shifting as easy as advancing the spark.

A thousand dealers handle Reo the Fifth. Write for our catalog and address of nearest showroom.



Top and windshield not included in price. We equip this car with mohair top side curtains and slip cover, windshield, gas tank for headlights, speedometer, self-starter, extra rim and brackets—all for $100 extra (list price $170). (Gray & Davis Electric Lighting and Starting System at an extra price, if wanted.)

R. M. Owen & Co. General Sales Agents for **Reo Motor Car Co., Lansing, Mich.**

Canadian Factory, St. Catharines, Ont.